

A1CE Curriculum Content

AiCE Program Team

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Chapter 1

Pillars

1.1 Artificial Intelligence Core

Subdomain	Code	Competency	Credits	Required?	Universities
Artificial Intelligence (AI)	AIC-101	Introduction to Artificial Intelligence	2	Yes	CMKL
	AIC-301	Symbolic AI	6	No	CMKL
	AIC-302	Probability-based Models	4	No	CMKL
	AIC-303	Planning and Search Strategies	4	Yes	CMKL
	AIC-304	Neural Networks and Deep Learning	4	Yes	CMKL
	AIC-305	Bio-inspired AI	4	No	CMKL
Machine Learning (ML)	AIC-504	Simulation	4	No	CMKL
	AIC-201	Supervised Learning and Unsupervised Learning	4	Yes	CMKL
	AIC-502	Reinforcement Learning	4	No	CMKL
Data Mining (DM)	AIC-503	Transformer Networks	4	No	CMKL
	AIC-401	Information Retrieval, Extraction, Search and Indexing	4	No	CMKL
	AIC-402	Proximity Measurement and Cluster Analysis	4	No	CMKL
AI Applications	AIC-403	Classification and Regression	4	No	CMKL
	AIC-601	Recommender System	4	No *	CMKL
	AIC-602	Natural Language Processing (NLP)	4	No *	CMKL
	AIC-603	Autonomous Agents	4	No *	CMKL
	AIC-604	Computer Vision	4	No *	CMKL
	AIC-605	Geographic Computing	4	No *	CMKL

* *AI Applications*: At least 1 of these competencies must be completed

Total credits for pillar AIC

All competencies: 72

Required competencies: 14

Required from option groups: 4

1.2 Communications and Presentation

Subdomain	Code	Competency	Credits	Required?	Universities
Communication and Presentation	COM-101	Research and Technical Writing	8	No	CMKL
	COM-102	Creative Writing	8	No	CMKL
	COM-103	Graphics and Visual Storytelling	8	No	CMKL
	COM-104	Public Speaking	4	No	CMKL
	COM-105	Presentation and Storytelling	8	No	CMKL
	COM-106	Project Management	10	No	CMKL
	COM-108	Academic Writing & Research	8	No	CMKL
	COM-201	Improviseational Acting	12	No	CMKL
	COM-202	Instructional Design	4	No	CMKL

Total credits for pillar COM

All competencies: 70

Required competencies: 0

Required from option groups: 0

1.3 Entrepreneurship and Innovation

Subdomain	Code	Competency	Credits	Required?	Universities
Entrepreneurship and Innovation	ENI-101	Create Innovation-driven Enterprise (Path Selection)	4	Yes	CMKL
	ENI-102	Design Thinking	4	Yes	CMKL
	ENI-103	Product Development	4	No	CMKL
	ENI-104	Intellectual Property	2	No	CMKL
	ENI-105	Startup from Idea to Impact	6	No	CMKL
	ENI-106	Building Effective Teams to drive Innovation	2	No	CMKL
	ENI-107	Entrepreneurial finance	4	No	CMKL
Game Business	ENI-408	Game Development & Production	6	No	CMKL
	ENI-409	Game content Monetization and Tokenomics	4	No	CMKL
	ENI-410	E-Sports & Ecosystem Development	4	No	CMKL
	ENI-411	Game Publishing and Marketing	4	No *	CMKL
Strategy and Innovation	ENI-201	Strategic Innovation Development	4	No	CMKL
	ENI-202	Business Strategy	2	No	CMKL
	ENI-203	Platform Strategy	4	No	CMKL
	ENI-304	AI for Business	12	No	CMKL
Leadership and Communication	ENI-301	Inclusive Leadership	2	No	CMKL
	ENI-302	Persuasive and Leadership Communication	4	No	CMKL
	ENI-303	Negotiation	4	No	CMKL
Business Application Domains	ENI-401	Retail and Services Applications	4	No *	CMKL
	ENI-402	Logistics	4	No *	CMKL
	ENI-403	Biomedical, Bioinformatics and Health	4	No *	CMKL
	ENI-404	Agriculture	4	No *	CMKL
	ENI-405	Fintech	4	No *	CMKL
	ENI-406	Educational Technology	4	No *	CMKL
	ENI-407	Gaming	4	No *	CMKL

* *Business Application Domains*: At least 1 of these competencies must be completed

Total credits for pillar ENI

All competencies: 104

Required competencies: 8

Required from option groups: 4

1.4 Arts, Humanities and Social Sciences

Subdomain	Code	Competency	Credits	Required?	Universities
People, Places and Cultures	HAS-101	Sociology and Cultural Anthropology	9	No	CMKL
	HAS-102	Social Psychology	9	No	CMKL
	HAS-103	Political Studies	9	No	CMKL
	HAS-104	Human Geography	9	No	CMKL
	HAS-105	Global Histories	9	No	CMKL
	HAS-109	Ethics and Policy Issues	2	No	CMKL
	HAS-110	Policy & Sustainable Development	6	No	CMKL
	HAS-113	AI and Computer Engineering for Community Impact I	4	No	CMKL
	HAS-123	AI and Computer Engineering for Community Impact II	4	No	CMKL
	HAS-133	AI and Computer Engineering for Community Impact III	4	No	CMKL
	HAS-143	AI and Computer Engineering for Community Impact IIII	4	No	CMKL
Economics	HAS-108	Behavioral Economics	8	No	CMKL
Arts and Music	HAS-106	History of Visual Arts	8	No	CMKL
	HAS-107	History of music	8	No	CMKL

Total credits for pillar HAS

All competencies: 93

Required competencies: 0

Required from option groups: 0

1.5 Human-Centered Design

Subdomain	Code	Competency	Credits	Required?	Universities
Designing for Human-Machine Teaming	HCD-103	Creating Explainable AI	4	No	CMKL
	HCD-502	Interaction Design & Experience Design	10	No	CMKL
	HCD-503	User Research: Methodologies, Data, and Design Thinking	4	No	CMKL
Analysis and Presentation (AP)	HCD-101	Visualization	4	Yes	CMKL
	HCD-104	Immersive Environment (AR/VR/MR/XR)	6	No	CMKL
Game Design	HCD-401	Game Development	6	No	CMKL
	HCD-402	Game Design	6	No	CMKL
	HCD-403	Narrative Design	6	No	CMKL
	HCD-404	Game Engine and Project Prototyping	6	No	CMKL
	HCD-405	Sound Design	4	No	CMKL
	HCD-406	Virtual Production	6	No	CMKL
	HCD-407	Visual Storytelling	6	No	CMKL
	HCD-408	Introduction to Spatial Gaming	4	No	CMKL
User Interface (UI) Design	HCD-501	Accessibility & Universal Design	2	Yes	CMKL
	HCD-504	Psychology for User Interface Design	4	No	CMKL
Engaging in Critical Oversight	HCD-201	Ethics in computer engineering	2	Yes	CMKL
	HCD-202	Ethical Principles for AI (Fairness, Accountability, Transparency, Ethics)	4	No	CMKL
Game Engineering	HCD-301	Game Engine Fundamentals	8	No	CMKL
	HCD-302	Engineered Arts	6	No	CMKL
	HCD-303	Engineered Arts: AI for Gaming	6	No	CMKL
	HCD-304	Character Animation and Motion Capture	4	No	CMKL

Total credits for pillar HCD

All competencies: 108

Required competencies: 8

Required from option groups: 0

1.6 Mathematics

Subdomain	Code	Competency	Credits	Required?	Universities
Mathematics for AI	MAT-201	Matrices and Linear Transformations (Linear algebra)	12	Yes	CMKL
	MAT-202	Signal Processing and Data Domains	4	No	CMKL
	MAT-203	Descriptive Statistics	2	Yes	CMKL
	MAT-204	Introduction to Probability	3	Yes	CMKL
	MAT-205	Probability Distributions	3	Yes	CMKL
	MAT-206	Statistical Inference	4	Yes	CMKL
	MAT-207	Discrete Mathematics	12	Yes	CMKL
Calculus	MAT-101	Calculus - Differentiation	3	No	CMKL
	MAT-102	Calculus - Basic derivatives	2	No	CMKL
	MAT-103	Calculus - Integration	4	No	CMKL
	MAT-104	Calculus - Optimization	3	No	CMKL
	MAT-105	Vector Calculus	6	No	CMKL
	MAT-106	Analytical Geometry	6	No	CMKL
	MAT-107	Differential Equations and Approximation	12	No	CMKL

Total credits for pillar MAT

All competencies: 76

Required competencies: 36

Required from option groups: 0

1.7 Science

Subdomain	Code	Competency	Credits	Required?	Universities
Science	SCI-101	Fundamentals of Biology	12	No	CMKL
	SCI-102	Fundamentals of Chemistry	12	No	CMKL
	SCI-104	Quantum Physics	12	No	CMKL
	SCI-105	Kinematics: describe motion (Physics I)	3	No	CMKL
	SCI-106	Dynamics: explain motion (Physics I)	3	No	CMKL
	SCI-107	Energy and Momentum (Physics I)	3	No	CMKL
	SCI-108	Thermodynamics (Physics I)	3	No	CMKL
	SCI-109	Electricity (Physics II)	4	No	CMKL
	SCI-110	Magnetism (Physics II)	4	No	CMKL
	SCI-111	Light and Optics (Physics II)	4	No	CMKL

Total credits for pillar SCI

All competencies: 60

Required competencies: 0

Required from option groups: 0

1.8 Cybersecurity

Subdomain	Code	Competency	Credits	Required?	Universities
Data Acquisition, Management, and Governance	SEC-101	Data and Information Fundamentals	2	Yes	CMKL
	SEC-102	Data Reduction and Compression	4	No	CMKL
	SEC-103	Data Governance	2	No	CMKL
Privacy, Security and Integrity	SEC-201	Data Privacy, Security and Integrity	4	Yes	CMKL
	SEC-203	Securing System Infrastructure	4	No	CMKL
	SEC-204	Security Policy and Processes	4	No	CMKL
	SEC-205	Distributed ledger and Blockchain	4	No	CMKL
	SEC-303	Vulnerability Assessment for Software Applications	4	No	CMKL
	SEC-401	Privacy Attacks	2	No	CMKL
	SEC-402	Differential Privacy (DP)	6	No	CMKL
AI System Security	SEC-301	Security Challenges in Modern AI Systems	2	Yes	CMKL
	SEC-302	Robustness of AI Components and Systems	4	No	CMKL

Total credits for pillar SEC

All competencies: 42

Required competencies: 8

Required from option groups: 0

1.9 Software Engineering

Subdomain	Code	Competency	Credits	Required?	Universities
Programming Fundamentals	SEN-101	Algorithmic Thinking & Problem Solving	2	Yes	CMKL
	SEN-102	Introduction to Programming	6	Yes	CMKL
	SEN-103	Programming Multi-module Applications	4	No	CMKL
	SEN-107	Fundamental Data Structures and Algorithms	6	Yes	CMKL
	SEN-109	Modern Systems Programming	2	No	CMKL
	SEN-208	Advanced Data Structures and Algorithms	6	No	CMKL
Programming Paradigms	SEN-209	Designing and implementing databases	6	No	CMKL
	SEN-304	Object Oriented Design and Programming	6	No	CMKL
	SEN-305	Functional Programming	4	No	CMKL
	SEN-306	Dataflow Programming	4	No	CMKL
Software Development and Maintenance (SDM)	SEN-307	Domain-specific programming languages	2	No	CMKL
	SEN-201	Software Engineering Processes	6	Yes	CMKL
	SEN-202	Software Quality Assurance	4	No	CMKL
	SEN-203	Software Design	4	No	CMKL
	SEN-205	Requirements Analysis and Problem Definition	2	No	CMKL
	SEN-212	Software Configuration Management	2	No	CMKL
	SEN-213	Software Measurement	2	No	CMKL
	SEN-214	Software Maintenance and Evolution	2	No	CMKL
	SEN-301	Designing and Building Secure Software	4	No	CMKL
	SEN-302	Designing and Building Mission Critical Software	2	No	CMKL
Software Engineering Leadership	SEN-401	Agile Development Processes (including DevOps)	2	No	CMKL
	SEN-402	Software Project Management	4	No	CMKL
	SEN-403	Software Organization Maturity and Continuous Improvement	2	No	CMKL
	SEN-404	Legacy Software Strategies	2	No	CMKL
	SEN-405	Open Source Software	2	No	CMKL
Platform Specific Architectures	SEN-311	Web Architectures	4	No	CMKL
	SEN-312	Mobile Application Architectures	4	No	CMKL

Total credits for pillar SEN

All competencies: 96

Required competencies: 20

Required from option groups: 0

1.10 Soft Skills

Subdomain	Code	Competency	Credits	Required?	Universities
Soft Skills	SOF-101	Adaptability - Semester 1	0	Yes	CMKL
	SOF-102	Adaptability - Semester 2	0	Yes	CMKL
	SOF-103	Adaptability - Semester 3	0	Yes	CMKL
	SOF-104	Adaptability - Semester 4	0	Yes	CMKL
	SOF-201	Empathy - Semester 1	0	Yes	CMKL
	SOF-202	Empathy - Semester 2	0	Yes	CMKL
	SOF-203	Empathy - Semester 3	0	Yes	CMKL
	SOF-204	Empathy - Semester 4	0	Yes	CMKL
	SOF-301	Ethics - Semester 1	0	Yes	CMKL
	SOF-302	Ethics - Semester 2	0	Yes	CMKL
	SOF-303	Ethics - Semester 3	0	Yes	CMKL
	SOF-304	Ethics - Semester 4	0	Yes	CMKL
	SOF-401	Proactiveness - Semester 1	0	Yes	CMKL
	SOF-402	Proactiveness - Semester 2	0	Yes	CMKL
	SOF-403	Proactiveness - Semester 3	0	Yes	CMKL
	SOF-404	Proactiveness - Semester 4	0	Yes	CMKL
	SOF-501	Professionalism - Semester 1	0	Yes	CMKL
	SOF-502	Professionalism - Semester 2	0	Yes	CMKL
	SOF-503	Professionalism - Semester 3	0	Yes	CMKL
	SOF-504	Professionalism - Semester 4	0	Yes	CMKL
	SOF-601	Self-Learning - Semester 1	0	Yes	CMKL
	SOF-602	Self-learning - Semester 2	0	Yes	CMKL
	SOF-603	Self-learning - Semester 3	0	Yes	CMKL
	SOF-604	Self-learning - Semester 4	0	Yes	CMKL
	SOF-701	Teamwork - Semester 1	0	Yes	CMKL
	SOF-702	Teamwork - Semester 2	0	Yes	CMKL
	SOF-703	Teamwork - Semester 3	0	Yes	CMKL
	SOF-704	Teamwork - Semester 4	0	Yes	CMKL

Total credits for pillar SOF

All competencies: 0

Required competencies: 0

Required from option groups: 0

1.11 Scalable Systems

Subdomain	Code	Competency	Credits	Required?	Universities
Computer Organization	SYS-101	Operating Systems	4	Yes	CMKL
	SYS-102	Basic Computer Architecture	4	Yes	CMKL
	SYS-202	Real Time Operating Systems	4	No	CMKL
	SYS-205	Storage and File Systems Fundamentals	2	No	CMKL
	SYS-206	Computer Design Processor Architectures and Digital Design	4	No	CMKL
	SYS-207	Networks	4	No	CMKL
	SYS-208	Digital and Analog Circuit Design	4	No	CMKL
Distributed Systems	SYS-301	Cyber Physical Systems	4	No	CMKL
	SYS-302	Cloud Computing	4	No	CMKL
	SYS-303	Scalable Management of Data and Models	4	No	CMKL
	SYS-304	Scalable Algorithms and Infrastructure	4	No	CMKL
	SYS-401	Parallel Computing	4	No	CMKL
	SYS-402	Distributed Data Storage	4	No	CMKL
	SYS-403	Big Data Computing	4	No	CMKL

Total credits for pillar SYS

All competencies: 54

Required competencies: 8

Required from option groups: 0

1.12 URD Undergraduate Research, Development and Practice

Subdomain	Code	Competency	Credits	Required?	Universities
Entrepreneurship and Innovation	URD-101	Undergraduate R&D Project (1)	9	Yes	CMKL
	URD-102	Undergraduate R&D Project (2)	9	Yes	CMKL
Senior Research & Development	URD-401	Honors Undergraduate Research Thesis (1)	12	No	CMKL
	URD-402	Honors Undergraduate Research Thesis (2)	12	No	CMKL
	URD-411	Undergraduate Capstone Project (1)	12	No	CMKL
	URD-412	Undergraduate Capstone Project (2)	12	No	CMKL
AI and Computer Engineering for Society	URD-201	Undergraduate R&D project (3)	9	Yes	CMKL
	URD-202	Undergraduate R&D Project (4)	9	Yes	CMKL
Experiential Learning (XP)	URD-301	Undergraduate R&D Project (5)	9	No *	CMKL
	URD-302	Undergraduate R&D Project (6)	9	No **	CMKL
	URD-311	Overseas Colleges (1)	9	No *	CMKL
	URD-312	Overseas Colleges (2)	9	No **	CMKL
	URD-321	Industrial Internship (1)	9	No *	CMKL
	URD-322	Industrial Internship (2)	9	No **	CMKL

* *Third Year R&D Semester 1*: At least 1 of these competencies must be completed

** *Third Year R&D Semester 2*: At least 1 of these competencies must be completed

Total credits for pillar URD

All competencies: 138

Required competencies: 36

Required from option groups: 18

Chapter 2

Competency Details

2.1 AIC Pillar

2.1.1 Details for Competency AIC-101

AIC-101: Introduction to Artificial Intelligence

Identity code: ALINTRO_2

Required? Yes

Credits: 2 (Graded)

Description

This competency considers the definition of artificial intelligence and provides an overview of AI methods and applications. It also gives students a brief introduction to the history of AI. We discuss the different approaches to AI with reference to the AI Core pillar in AiCE. Finally we conclude by considering the many societal issues raised by the modern proliferation of AI.

Responsible Instructor: Sally Goldin

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-101:00010	Characteristics of an AI system or model	Hands-on problem	Apply knowledge of AI systems and concepts : Write a 2-3 page essay answering an assigned question that requires an understanding of AI principles, systems and history.	Analyze	3	3
Category		Code	Learning Outcome			
Engineering SLO		1	Engineering problem solving			
		2	Designing to meet requirements			
		3	Effective communication			
		4	Ethical awareness			
		5	Teamwork			
		6	Experimental design and data analysis			
		7	Self-learning			
Computing SLO		1	Computational problem solving			
		2	Designing, implementing and evaluating from requirements			
		3	Effective communication			
		4	Ethical and professional awareness			
		5	Teamwork			

2.1.2 Details for Competency AIC-301

AIC-301: Symbolic AI

Identity code: SYMBOLIC_AI.6

Required? No

Credits: 6 (Graded)

Description

This competency provides you with an understanding of the basic principles and techniques used in Symbolic AI, such as knowledge representation, logical reasoning, search and planning. You will learn how to develop intelligent systems that can search, reason, plan, and solve problems, using symbolic representations and logical reasoning.

Responsible Instructor: Sarun Gulyanon

Prerequisites

- SEN-107 - Fundamental Data Structures and Algorithms
- AIC-101 - Introduction to Artificial Intelligence

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-301:00010	Knowledge Representation	Hands-on problem	Understand and use the knowledge representation: Analyze a given scenario and apply a suitable knowledge representation method to structure and describe the information. And justify the choice of representation by explaining why it is appropriate for the scenario, considering factors like the complexity of the relationships involved and the clarity of the representation.	Analyze	3	3
AIC-301:00020	Reasoning & Inference using Symbolic Logic	Hands-on problem	Apply reasoning and inference using symbolic logic: Write a Prolog program that implements the symbolic logic to represent the information in the given scenario and interpret simple formulas.	Apply	1	1
AIC-301:00030	Expert Systems	Hands-on problem	Apply rule-based expert systems: Write a Prolog program that implements a rule-based expert system for the given scenario using either forward or backward chaining technique.	Apply	1	1
AIC-301:00040	Search & Problem Solving	Hands-on problem	Apply search algorithms : Write two Prolog programs that implements search algorithms to solve the given problem using both breadth-first and depth-first search methods.	Apply	1	1
AIC-301:00050	Constraint Satisfaction	Hands-on problem	Solve constraint satisfaction problem: Write a Prolog program to solve the constraint satisfaction problem of the given scenario using a variation of the depth-first search method.	Apply	1	1
AIC-301:00060	Planning	Hands-on problem	Apply planning techniques: Design a STRIPS planner for the given scenario and write a Prolog program that represents this STRIPS problem and planner.	Apply	1	1
AIC-301:00070	Uncertainty	Hands-on problem	Apply probability framework for dealing with uncertainty: Design a Bayesian network that deals with scenario with uncertainty and write a program that represents this Bayesian network.	Apply	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.3 Details for Competency AIC-302

AIC-302: Probability-based Models

Identity code: PROB_AI_MODELS_4

Required? No

Credits: 4 (Graded)

Description

This competency introduces students to a variety of approaches to learning and decision-making that depend on probabilities. In particular, it considers the construction, use and variations of Bayesian models.

Responsible Instructor: Irving Gomez Mendez

Prerequisites

- MAT-205 - Probability Distributions
- AIC-201 - Supervised Learning and Unsupervised Learning

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-302:00020	Probability Models	Hands-on problem	Assessment: The concept of Probability-based Models: Use a probability-based technique to model a problem and find a solution	Understand	1, 2	1, 2
Category		Code	Learning Outcome			
Engineering SLO		1	Engineering problem solving			
		2	Designing to meet requirements			
		3	Effective communication			
		4	Ethical awareness			
		5	Teamwork			
		6	Experimental design and data analysis			
		7	Self-learning			
Computing SLO		1	Computational problem solving			
		2	Designing, implementing and evaluating from requirements			
		3	Effective communication			
		4	Ethical and professional awareness			
		5	Teamwork			

2.1.4 Details for Competency AIC-303

AIC-303: Planning and Search Strategies

Identity code: PLANNING_SEARCH_4

Required? Yes

Credits: 4 (Graded)

Description

This competency introduces the core AI concept of a solution space and recasts problem solving as the process of searching that space and evaluating potential solutions.

Responsible Instructor: Antoine Merlet

Prerequisites

- SEN-107 - Fundamental Data Structures and Algorithms
- AIC-101 - Introduction to Artificial Intelligence

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-303:00010	Problem Spaces	Hands-on problem	Assessment: Formulate a problem in terms of searching a solution space: Given a problem that involves optimizing multiple objectives, show how it can be represented in terms of search and propose a solution method.	Analyze	1	1
AIC-303:00040	State space search	Hands-on problem	Assessment: Create a program that can play board game using uninformed search (e.g. chess): Implement a simple chess AI using iterative deepening or other uninformed search algorithms to determine the next best move	Create	1, 2	1, 2
AIC-303:00050	Planning & search consideration for real-world app	Quiz or exam	Assessment: Describe a sample plan and search consideration for real-world app: Compile a list of potential problems that can be solved by search	Understand	7	None
AIC-303:00060	State space search	Hands-on problem	Assessment: Pathfinding using heuristic search: Implement a pathfinding algorithm (e.g. using A* or other heuristics search) to navigate a game character to a destination on a map with random obstacles	Create	1, 2	1, 2
AIC-303:00070	State space search	Hands-on problem	Assessment: Implement a route planning algorithm for a map application: Formulating the turn-by-turn navigation problem using planning/search strategies and implement an algorithm to suggest a route given traffic condition and a map	Create	1, 2	1, 2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.5 Details for Competency AIC-304

AIC-304: Neural Networks and Deep Learning

Identity code: DEEP_LEARNING_4

Required? Yes

Credits: 4 (Graded)

Description

This competency introduces the core concepts behind so called "deep learning" models, which use a series of many layers to extract features and patterns from a set of input data. The main focus is on convolutional neural networks, important for computer vision and related classification tasks.

Responsible Instructor: Jidapa Thadajarassiri

Prerequisites

- AIC-201 - Supervised Learning and Unsupervised Learning
- MAT-207 - Discrete Mathematics

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-304:00010	Feed Forward	Hands-on problem	Understand and implement feed forward for a model: Given models with different structures, use pytorch to implement the forward path for them	Apply	1	1
AIC-304:00020	Back-propagation	Hands-on problem	Understand and implement back-propagation for a model: Given a dataset, use pytorch to implement an end-to-end training process to learn parameters for the model through backpropagation	Apply	1	1
AIC-304:00040	Modeling Concept	Hands-on problem	Understand and be able to implement a deep learning model for a real-world dataset: Explain the meaning of the given terminologies and explain the developing plan for implementing a deep learning model on the given scenarios	Understand	3	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.6 Details for Competency AIC-305

AIC-305: Bio-inspired AI

Identity code: BIO_AI_MODELS_4

Required? No

Credits: 4 (Graded)

Description

This competency examines a variety of algorithms for solving difficult or computationally intractable problems using techniques borrowed from natural processes. It includes a consideration of genetic algorithms and some representative examples of swarm intelligence.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-102 - Introduction to Programming
- AIC-101 - Introduction to Artificial Intelligence

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-305:00010	Rationale for bio-inspired AI	Quiz or exam	Assessment: Rationale for bio-inspired AI: Write an original two page essay that succinctly explains what bio-inspired algorithms are, when they are likely to be useful, and how they compare to other artificial intelligence approaches. Include specific examples with citations.	Understand	3, 7	3
AIC-305:00020	Genetic algorithms	Hands-on problem	Assessment: Genetic algorithms: Given a problem appropriate to a GA approach, design and implement an original program that solves that problem using evolutionary algorithms.	Create	1, 2	1, 2
AIC-305:00030	Swarm intelligence	Hands-on problem	Assessment: Swarm intelligence: Given a problem appropriate to a swarm intelligence approach, design, implement and test a program that uses a well-known swarm intelligence algorithm to solve it.	Create	1, 2	1, 2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.7 Details for Competency AIC-504

AIC-504: Simulation

Identity code: SIMULATION_4

Required? No

Credits: 4 (Graded)

Description

This competency explores various methods for building an executable model that mimics the behavior of some real world system. We consider different types of models: deterministic versus stochastic, monolithic versus agent-based, classical versus AI-powered (based on deep learning models). Students will learn how to analyze real-world systems, choose appropriate simulation techniques and build simulation models using those techniques.

Responsible Instructor: Sally Goldin

Prerequisites

None

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-504:00010	Mathematical and stochastic simulations	Hands-on problem	Create a simple stochastic simulation: Given the description of a system, model it using stochastic simulation techniques then describe its behavior	Create	1, 2, 3	1, 2, 3
AIC-504:00020	Agent-based simulations	Hands-on problem	Create an agent-based simulation: Given a description of a system or problem with multiple independent entities (for instance, traffic, epidemic contacts), create an agent-based simulation then describe its behavior	Create	1, 2, 3	1, 2, 3
AIC-504:00030	Digital twins	Hands-on problem	Understand and apply the concept of digital twins: Find a detailed description in the literature of a digital twin. Analyze this system from the perspective of simulation, highlighting both the benefits and the issues raised.	Analyze	3, 7	3
AIC-504:00040	AI and simulation	Hands-on problem	Design a simulation that uses AI techniques: Create a design document that explains how you would build an AI-based simulation to model some specific system. This skill involves not only figuring out the issues and steps in building the AI-based simulation, but also the ability to recognize when a particular problem or real-world system would benefit from an AI-based simulation approach.	Create	2, 3, 7	2, 3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.8 Details for Competency AIC-201

AIC-201: Supervised Learning and Unsupervised Learning

Identity code: SUP_UNSUP_ML4

Required? Yes

Credits: 4 (Graded)

Description

This competency introduces fundamental machine learning concepts including models, supervised versus unsupervised techniques, training versus testing data, data bias, and so on. Students have the opportunity to build traditional unsupervised versus supervised models on sample data sets as well as to explore basic neural networks.

Responsible Instructor: Sally Goldin

Prerequisites

- AIC-101 - Introduction to Artificial Intelligence

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-201:00010	Core ML concepts	Hands-on problem	Assessment: Understanding fundamental ML concepts: Find and explain an example of machine learning in the literature, discussing and evaluating the example in terms of concepts such as data dimensions, supervised versus unsupervised techniques, etc.	Analyze	3, 7	3
AIC-201:00020	Unsupervised learning methods	Hands-on problem	Assessment: Applying unsupervised learning methods: Given an unlabeled set of data, use a third party framework like sklearn or Weka to do K-Means clustering. Vary the number of clusters and repeat. Write one to two pages describing and interpreting the results.	Apply	1	1
AIC-201:00030	Supervised learning methods	Hands-on problem	Assessment: Applying supervised learning methods: Given a labeled data set, use a framework like sklearn or Weka to train a decision tree, then test its accuracy. Vary several of the parameters and repeat. Write one to two pages describing and interpreting the results.	Apply	1	1
AIC-201:00040	Neural network fundamental concepts	Hands-on problem	Assessment: Train and evaluate a simple neural network: Given a data set for a simple classification problem, train a neural network to perform the classification, then evaluate its performance.	Evaluate	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.9 Details for Competency AIC-502

AIC-502: Reinforcement Learning

Identity code: REINFORCEMENT_ML_4

Required? No

Credits: 4 (Graded)

Description

Reinforcement learning is a branch of machine learning that operates using the principle of rewards for desired behavior. This competency explores the general concepts behind reinforcement learning, as well as several techniques and architectures for building RL systems.

Responsible Instructor: Irving Gomez Mendez

Prerequisites

- MAT-207 - Discrete Mathematics
- AIC-201 - Supervised Learning and Unsupervised Learning

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-502:00010	Core Reinforcement Learning Concepts	Hands-on problem	Given a learning example, clearly define it in term of (1) supervised learning and (2) reinforcement learning. Able to identify all important terms and assumptions in RL. Analyzing and evaluating difference results between (1) and (2). Discussing appropriate situations when to use (1) or to use (2): Given a learning example, clearly define it in term of (1) supervised learning and (2) reinforcement learning. Able to identify all important terms and assumptions in RL. Analyzing and evaluating difference results between (1) and (2). Discussing appropriate situations when to use (1) or to use (2)	Analyze	3	3
AIC-502:00020	Standard Reinforcement Learning Tools	Hands-on problem	Assessment: Standard Reinforcement Learning Tools: Given a problem, apply various RL algorithms on standard tools to solve it using RL	Analyze	1	1
AIC-502:00030	Classic Reinforcement Learning Methods	Hands-on problem	Given a problem and Gym environment, use a Q-learning framework to train a model to solve the problem efficiently . Evaluating the results and lesson learned: Given a problem and Gym environment, use a Q-learning framework to train a model to solve the problem efficiently . Evaluating the results and lesson learned	Analyze	1, 3	1, 3
AIC-502:00040	Deep Reinforcement Learning Concepts	Hands-on problem	Assessment: Deep Reinforcement Learning Concepts: Given a problem and Gym environment, use a Deep Q-learning framework to train a model to solve the problem efficiently . Evaluate the results and lesson learned	Analyze	1, 3, 6	1, 3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.10 Details for Competency AIC-503

AIC-503: Transformer Networks

Identity code: TRANSFORMER_ML4

Required? No

Credits: 4 (Graded)

Description

A transformer is a deep learning architecture on the multi-head attention mechanism, which is widely used in modern language processing and other applications that generate novel outputs.

Responsible Instructor: Kawisorn Kamtue

Prerequisites

- MAT-207 - Discrete Mathematics
- AIC-201 - Supervised Learning and Unsupervised Learning

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-503:00010	Encoder Decoder	Hands-on problem	Assessment: Understanding the concept of encoder decoder: Explain pictorially how encoder and decoder works with specific examples	Understand	3	3
AIC-503:00020	Attention mechanism	Hands-on problem	Assessment: Attention mechanism: Write a simple function that demonstrates the attention mechanism at the core of transformer architectures	Create	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.11 Details for Competency AIC-401

AIC-401: Information Retrieval, Extraction, Search and Indexing

Identity code: INFO_EXTRACTION_4

Required? No

Credits: 4 (Graded)

Description

This competency delves into various techniques for extracting information from structured or unstructured data sets, and for building systems that allow this information to be accessed quickly based on content or goals.

Responsible Instructor: Akkarit Sangpetch

Prerequisites

- SEN-107 - Fundamental Data Structures and Algorithms
- AIC-101 - Introduction to Artificial Intelligence

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-401:00010	Indexing and retrieval	Hands-on problem	Understand text indexing and retrieval: Assignment on text indexing and retrieval	Understand	1	1
AIC-401:00020	Document representation	Hands-on problem	Understand document representation and similarity measures: Assignment on document representation and similarity measures	Understand	None	None
AIC-401:00030	Ranking algorithms	Hands-on problem	Understand ranking algorithms: Assignment on ranking algorithms	Understand	None	None
AIC-401:00040	Advanced retrieval	Hands-on problem	Create machine learning-based retrieval system: Assignment on retrieval system	Create	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.12 Details for Competency AIC-402

AIC-402: Proximity Measurement and Cluster Analysis

Identity code: CLUSTER_ANALYSIS_4

Required? No

Credits: 4 (Graded)

Description

Proximity measures are mathematical techniques that calculate the similarity/dissimilarity of data points. Cluster analysis is a technique to group similar observations into a number of clusters based on the observed values of several variables for each individual.

Responsible Instructor: Akkarit Sangpetch

Prerequisites

- MAT-205 - Probability Distributions
- AIC-201 - Supervised Learning and Unsupervised Learning

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-402:00010	Similarity metrics	Quiz or exam	Assessment: Similarity metrics: Given a list of similarity metrics, explain how each one is calculated and summarize its strengths and weaknesses	Understand	3	3
AIC-402:00020	Clustering algorithms	Hands-on problem	Assessment: Clustering algorithms: Given a set of data, write program that will cluster that data using two common clustering techniques, e.g. K-Means clustering and hierarchical clustering	Create	1, 2	1, 2
AIC-402:00030	Applications of similarity and clustering	Hands-on problem	Assessment: Applications of similarity and clustering: Write an essay about a specific application of clustering and how it can be used to solve a real world problem. Include examples plus a discussion of what clustering techniques are most appropriate for this application.	Evaluate	3	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.13 Details for Competency AIC-403

AIC-403: Classification and Regression

Identity code: CLASS.REGRESS_6

Required? No

Credits: 4 (Graded)

Description

In this class, students will learn about classification and regression which are the main pillars of data science. While this course covers well-known state-of-the-art algorithms and their concepts, it is heavily focused on the real-world applications of classification and regression. Some of the covered algorithms are XGBoost, Random Forest, ARIMA, and YOLO (but not limited to). There are short writing assignments and a final project at the end. Lab sessions will be conducted in Python, scikit-learn, and TensorFlow.

Responsible Instructor: Boonyarit Changaival

Prerequisites

- MAT-207 - Discrete Mathematics
- AIC-201 - Supervised Learning and Unsupervised Learning

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-403:00010	Applied Machine Learning	Hands-on problem	Assessment: the concept of machine learning: Understand and able to distinguish situations where machine learning is needed and when other approaches can be used. Writing assignment 1-2 pages of an example classification problem and methods to solve it.	Analyze	3	3
AIC-403:00020	Classification	Hands-on problem	Assessment: analyze and implement classification algorithms: Able to analyze and implement classification algorithms to be used in given contexts and able to select suitable performance metrics along with the algorithms. Writing assignment 1-2 pages of an example classification problem and methods to solve it.	Apply	3	3
AIC-403:00030	Regression	Hands-on problem	Assessment: Able to analyze and implement regression algorithms: Able to analyze and implement regression algorithms to be used in given contexts and able to select suitable performance metrics along with the algorithms. Writing assignment 1-2 pages of an example regression problem and methods to solve it.	Apply	3	3
AIC-403:00040	K-Nearest Neighbours	Hands-on problem	Assessment: Use K-NN as a classifier: Given a labelled data and input queries, determine the classes of the output	Apply	1	1
AIC-403:00050	Decision Tree	Hands-on problem	Assessment: Use a decision tree as a classifier: Given a labelled data, design a decision tree for classification	Apply	1	1
AIC-403:00060	SVM	Hands-on problem	Assessment: Use SVM as a classifier: Given data points of two classes, draw a decision boundary by SVM that separates the two classes	Apply	1	1
AIC-403:00070	Classification and Regression	Imported assessment	Assessment: Evaluation the Classification and Regression concept: Project assignment A report of 5-10 pages on the results of the study and a presentation. Able to do further research and use foundation learning in this course to understand others state-of-the-art or novel algorithms.	Create	<i>None</i>	<i>None</i>
AIC-403:00080	Classification and Regression	Hands-on problem	Assessment: Able to communicate research methodology and outcomes to audiences.: Project assignment A report of 5-10 pages on the results of the study and a presentation.	Create	3, 6	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.14 Details for Competency AIC-601

AIC-601: Recommender System

Identity code: RECOMMENDER_4

Required? No

Credits: 4 (Graded)

Option Group: AI Applications

Description

Recommender systems use accumulated data about past choices or preferences to compute a set of alternatives to be offered to a user. Recommender systems lie at the heart of e-commerce platforms, entertainment platforms and social media.

Responsible Instructor: Pakpoom Buabthong

Prerequisites

- MAT-207 - Discrete Mathematics
- AIC-201 - Supervised Learning and Unsupervised Learning

Distribution Areas

- Core Technical
- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-601:00010	Basic concepts of recommendation systems	Hands-on problem	Assessment: Identify type of inputs required for different recommender systems: Given different input matrices (Item-Content vs User-Rating), identify the appropriate algorithms or techniques suitable for the input.	Understand	3	3
AIC-601:00020	Evaluation of recommendation systems	Hands-on problem	Assessment: Evaluate the quality of a given recommendation system: Given two distinct recommender systems, evaluate their quality and make recommendation regarding the system selection.	Evaluate	1, 3	1, 3
AIC-601:00030	Content-based filtering	Hands-on problem	Assessment: Implement a recommender system using content-based filtering approach, given product descriptions: Given a set of product descriptions (e.g. movie synopsis), implement a recommender system based on the similarity of product description	Create	1, 2	1, 2
AIC-601:00040	Collaborative filtering	Hands-on problem	Assessment: Evaluate the effectiveness of a collaborative filtering-based recommender system using user preference: Given multiple user rankings of product preference (e.g book review), evaluate the effectiveness of a recommender system based on the product rating and similar user's profile or ratings.	Evaluate	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.15 Details for Competency AIC-602

AIC-602: Natural Language Processing (NLP)

Identity code: NLP_4

Required? No

Credits: 4 (Graded)

Option Group: AI Applications

Description

Natural Language Processing applications use written text and/or speech data to perform linguistic tasks such as question answering, search and conversational interactions. NLP applications can also analyze text content (e.g. comments on an e-commerce site) to draw conclusions about sentiment and other language dimensions.

Responsible Instructor: Ekapol Chuangsuwanich

Prerequisites

- MAT-207 - Discrete Mathematics
- AIC-101 - Introduction to Artificial Intelligence

Distribution Areas

- Core Technical
- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-602:00010	NLP Pipeline & Tokenization	Quiz or exam	Text cleaning and tokenization: Assignment on text tokenization	Understand	3	3
AIC-602:00020	Language Modeling and word representation	Quiz or exam	Training a language model and be able to analyze the embedding properties: Assignment on language modeling	Understand	3	3
AIC-602:00030	Token classification	Quiz or exam	Able to perform token classification tasks.: Assignment on a token classification task	Understand	3	3
AIC-602:00040	Text classification	Quiz or exam	Able to perform text classification tasks.: Assignment on a text classification task	Understand	3	3
AIC-602:00050	Text generation	Quiz or exam	Able to perform text generation tasks: Assignment on a text generation task	Understand	3	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.16 Details for Competency AIC-603

AIC-603: Autonomous Agents

Identity code: AUTO_AGENTS_4

Required? No

Credits: 4 (Graded)

Option Group: AI Applications

Description

Autonomous agent applications involving multiple independent AI models or entities that cooperate to perform some task or solve some problem. Autonomous agents may be embodied as robotic entities or may be software only, depending on the task. This competency introduces the core concepts in an autonomous agent system as well as principles for designing and evaluating them.

Responsible Instructor: Pitikhate Sooraksa

Prerequisites

- MAT-207 - Discrete Mathematics
- AIC-101 - Introduction to Artificial Intelligence

Distribution Areas

- Core Technical
- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-603:00010	Fundamental Concepts	Quiz or exam	Assessment: Fundamental Concepts : Create a conceptual map that visually represents the connections between autonomous agent concepts..	Understand	3	3
AIC-603:00020	Engineering Analysis and Design	Hands-on problem	Assessment: Engineering Analysis and Design: Designing and implement an autonomous agent system to control the environment in a closed agricultural system.	Create	1, 2, 3, 4, 5, 6	1, 2, 3, 4, 5
AIC-603:00030	Performance Evaluation	Hands-on problem	Assessment: Performance Evaluation: Select and experiment with a platform that allows creating autonomous agents (i.e. Auto-AGI, Camel, Alice, LaMDA 3, Jarvis, BabyAGI or AutoAgents) and write a report on assessing the performance of the platform, a framework for generating and coordinating specialized AI agents to tackle complex tasks.	Evaluate	1, 2, 3	1, 3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.17 Details for Competency AIC-604

AIC-604: Computer Vision

Identity code: COMPUTER_VISION_4

Required? No

Credits: 4 (Graded)

Option Group: AI Applications

Description

This competency introduces concepts and techniques that allow a computer system to analyze and understand visual representations such as images, video, drawings and diagrams. It covers tools and methods for important computer vision tasks including image transformations, feature descriptors and matching, segmentation, and object detection.

Responsible Instructor: Jamie A. O'Reilly

Prerequisites

- MAT-207 - Discrete Mathematics
- AIC-101 - Introduction to Artificial Intelligence

Distribution Areas

- Core Technical
- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-604:00010	Fundamental digital image processing	Hands-on problem	Understand and apply a range of fundamental digital image transformations used in computer vision: Pre-process digital images using basic image transformations for computer vision applications	Analyze	1	1
AIC-604:00020	Image segmentation and shape analysis	Hands-on problem	Apply image segmentation algorithms and evaluate their performance: Segment digital images and analyze the result	Create	1, 2	1, 2
AIC-604:00030	Feature matching	Hands-on problem	Analyze image features used in matching and tracking algorithms: Use feature matching and tracking algorithm to track object in moving images	Evaluate	1, 2	1, 2
AIC-604:00040	Object detection and tracking	Hands-on problem	Create object detection and tracking algorithm using pre-trained object detection models: Develop an image processing application that uses object detection	Evaluate	1, 2	1, 2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.1.18 Details for Competency AIC-605

AIC-605: Geographic Computing

Identity code: GEO_COMP_4

Required? No

Credits: 4 (Graded)

Option Group: AI Applications

Description

This competency introduces techniques for representing and manipulating spatial information in computer applications, focusing on vector and raster representations. It compares algorithmic and classical ML approaches in geocomputing with heuristic models and deep learning.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-107 - Fundamental Data Structures and Algorithms
- AIC-101 - Introduction to Artificial Intelligence

Distribution Areas

- Core Technical
- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
AIC-605:00010	Geographic Computing	Hands-on problem	Demonstrate the ability to use and reason about locations: Complete a hands-on exercise using lat/long, map scale and projections	Apply	1	1
AIC-605:00020	Geographic Computing	Hands-on problem	Apply the principles of vector representation to a problem: Complete a hands-on programming assignment that involves using vector entities and transforming them to raster entities.	Create	1	1
AIC-605:00030	Geographic Computing	Hands-on problem	Apply the principles of raster representation to a problem: Complete a program that demonstrates understanding of raster representation, including transforming a raster to a vector representation.	Create	1	1
AIC-605:00040	Geographic Computing	Hands-on problem	Analyze code that implements algorithmic geocomputing techniques: Given a set of code that does some geocomputing using either Dijkstra's algorithm (vector) or maximum likelihood classification (raster) plus some guiding questions, analyze and explain the code	Analyze	1	1
AIC-605:00050	Geographic Computing	Hands-on problem	Assessment: Geographic Computing: Create either a GA-based multi-criteria routing application (vector), a travel time prediction application (vector) or a deep-learning based image segmentation/classification application (raster) as a group project. Write a paper explaining how the code works, as a group assignment.	Create	1, 3, 6	1, 3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.2 COM Pillar

2.2.1 Details for Competency COM-101

COM-101: Research and Technical Writing

Identity code: RESEARCH_WRITING_8

Required? No

Credits: 8 (Graded)

Description

Research and Technical Writing explores advanced research methodologies and effective communication techniques. Students will develop skills in critical analysis, data interpretation and presentation, and professional documentation. The course emphasizes clarity, precision, and coherence in writing technical reports, proposals, and research papers, preparing students for academic and professional success.

Responsible Instructor: Sally Goldin

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
COM-101:00010	Units of written language: clauses, sentences and paragraphs	Hands-on problem	Demonstrate the ability to create clear, grammatical sentences and paragraphs: Given a topic, write clear sentences and paragraphs that expand on this topic.	Create	3	3
COM-101:00020	Exposition patterns (logical structure for arguments)	Hands-on problem	Apply exposition patterns presenting a written argument: Given a topic, choose and apply an appropriate exposition pattern in writing about the topic. Identify the exposition pattern selected and explain why you chose it.	Create	3	3
COM-101:00030	Problem statements	Hands-on problem	Create a clear and compelling statement of a problem: Create an introduction to a written document that clearly and compellingly states the problem the document is intended to address.	Create	3	3
COM-101:00040	Organization of a technical or research document	Hands-on problem	Apply knowledge about the typical organization of technical and research documents : Create a detailed outline for a technical document with an assigned category and theme.	Create	3	3
COM-101:00050	Technical writing style conventions	Hands-on problem	Understand and apply document style conventions for technical and research documents.: Write a research document on a provided topic, following formal style conventions.	Create	3	3, 4
COM-101:00060	Literature reviews including citations and references	Hands-on problem	Write a literature review: Given a topic, read and summarize relevant sources about this topic. Then write an effective literature review, including in-document citations and a list of references.	Create	3	3, 4
COM-101:00070	Effective presentation of data (graphs, tables)	Hands-on problem	Design and use data presentations effectively: Given a set of raw data, create graphs or tables that clearly communicate the insights or conclusions one can draw from the data. Then write text that would accompany the data presentation, guiding the reader through the presentation and highlighting the main points.	Create	3	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.2.2 Details for Competency COM-102

COM-102: Creative Writing

Identity code: CREATIVE_WRITING_8

Required? No

Credits: 8 (Graded)

Description

Everyone has a narrative, and every piece of communication should therefore be informed by the structure of story. The theory of this is narrative design (HCD-403), and the execution of this is creative writing (COM-102).

The range of applications for creative writing are therefore extremely broad, and could include:

- Populating a massive game world with dialogue and lore; - Pitching a concept to investors; - Crafting a compelling user experience in a website; - Producing a YouTube/TikTok script; - Producing a film or documentary; - Building and communicating a brand across social media channels.

There are countless more applications, but the central skill remains the same: the capacity to distill elegant concepts into clear and compelling prose.

An interactive digital media project is the ideal outcome for this course, as it merges software engineering with creative writing within AiCE's Game Engineering Track (GET). However, AiCE students may also elect a business-oriented focus (i.e. URD project material production, for example) and produce scripts for commercials, marketing materials, and interactive interfaces in other industries.

NOTE: Students who have already taken HCD-403 are recommended to take this course as well, as previous projects may be continued (and completed) in this course with a reduced requirement to attend overlapping lectures (of which there are two).

Responsible Instructor: Justin Paulsen

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
COM-102:00010	Interactive Fiction & Software Engineering	Hands-on problem	Creative Writing Formats: Each student will select a path (interactive digital media, traditional media, OR business-oriented project) and begin outlining the core deliverable for this course.	Apply	1, 2	2, 3
COM-102:00030	The Structure of Story	Hands-on problem	Narrative Design: Apply or develop a narrative design to guide the project. Students who have taken HCD-403 may skip this assessment.	Understand	2, 5	2
COM-102:00050	Narrative Prototyping & Dialogue Writing	Hands-on problem	Structural Writing: Students will begin creative writing in earnest, and attempt to craft key moments/beats within their creative writing project, to be shared and critiqued with the class.	Create	1, 2	1, 2
COM-102:00070	Writing at Scale	Hands-on problem	Professional Creative Writing: They will be expected to expand on their basic design and structure to populate a full game script (Articy/Twine) or a comprehensive marketing campaign (social media posts and posting schedule, multiple short video commercials, and a user-driven and interactive app/website design towards KPIs).	Apply	2, 3	2, 3, 4
COM-102:00080	Interactive Fiction & Software Engineering	Hands-on problem	Interactive Creative Writing: This could include gameplay mechanics, interactive UI, education technology applications, or other immersive environments requiring text-based interactions.	Apply	1, 3	2, 3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.2.3 Details for Competency COM-103

COM-103: Graphics and Visual Storytelling

Identity code: VISUAL_STORY_8

Required? No

Credits: 8 (Graded)

Description

Explore the art of visual storytelling through graphics. This course delves into principles of design, color theory, and narrative composition to create compelling visual narratives. From digital illustration to infographic design, learn to communicate ideas effectively through images, enhancing your ability to engage and inform audiences across various media platforms.

Responsible Instructor: Lorenzo Avi

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
COM-103:00010	Foundations of Visual Storytelling	Quiz or exam	Understand the foundations of Graphics and Visual Storytelling: Multiple-choice questions on the importance of visual storytelling and basic design principles.	Understand	3	3
COM-103:00020	Visual Composition and Techniques	Imported assessment	Understand the Visual Design Techniques: Design Project: Create a poster or infographic applying color theory, typography, and layout principles (assessing application of visual design techniques).	Create	3	3
COM-103:00030	Tools and Software for Visual Storytelling	Imported assessment	Create Storytelling with Graphics: Infographic Creation: Develop an infographic that tells a story using data and visuals (assessing ability to create effective infographics).	Create	3	3
COM-103:00040	Advanced Visual Storytelling Techniques	Imported assessment	Designing interactive and motion graphics: Motion Graphic Project: Create a short motion graphic video to tell a story (assessing ability to design motion graphics).	Create	3	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.2.4 Details for Competency COM-104

COM-104: Public Speaking

Identity code: PUBLIC_SPEAKING_4

Required? No

Credits: 4 (Graded)

Description

Public Speaking offers practical guidance for preparing and delivering professional presentations, as well as communicating effectively in professional contexts. The course includes activities and assignments such as crafting targeted, strategic messages, writing outlines, designing cohesive visuals, exploring new technologies, and speaking extemporaneously. Students will learn to engage specific audiences using both verbal and nonverbal communication styles that are appropriate for workplace settings. Overall, this course aims to help students build confidence and apply effective public speaking techniques.

Responsible Instructor: Gunyootapong Nopakun

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
COM-104:00010	Foundations of Public Speaking	Observational assessment	Understanding the role and impact of public speaking: Audience Analysis Report: Analyze a target audience for a given speech scenario (assessing audience analysis skills).	Analyze	3	3
COM-104:00020	Speech Preparation and Structure	Interview/oral exam	Researching and Gathering Information: Outline Assignment: Create an outline for a given speech topic (assessing structuring and outlining skills). Short Speech: Prepare and deliver a 2-3 minute speech focusing on structure (assessing the ability to organize and present information effectively).	Apply	3	3
COM-104:00030	Delivery Techniques and Audience Engagement	Interview/oral exam	Evaluate Delivery Techniques and Audience Engagement: Voice Exercise: Record and analyze voice modulation practices (assessing voice modulation and clarity). Non-Verbal Communication Role-Play: Participate in a role-play focusing on body language and gestures (assessing non-verbal communication skills). Interactive Speech: Deliver a speech with planned audience interactions (assessing audience engagement techniques). Q&A Session: Handle a Q&A session after the speech, demonstrating engagement and interaction skills (assessing ability to handle audience questions).	Evaluate	3	3
COM-104:00040	Advanced Public Speaking Skills	Interview/oral exam	Deliver Advanced Public Speaking : Persuasive Speech Outline: Develop an outline for a persuasive speech (assessing ability to craft persuasive arguments). Persuasive Speech Delivery: Deliver a 5-7 minute persuasive speech (assessing persuasive speaking skills). Special Occasion Speech: Prepare and deliver a speech for a special occasion (assessing ability to prepare and deliver speeches for specific contexts). Self-Evaluation Report: Analyze and report on a recorded speech performance, focusing on areas for improvement (assessing self-evaluation and improvement skills). Peer Feedback Session: Provide and receive feedback on speech performances (assessing ability to give and incorporate feedback for continuous improvement).	Create	3	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.2.5 Details for Competency COM-105

COM-105: Presentation and Storytelling

Identity code: PRESENT_STORY_8

Required? No

Credits: 8 (Graded)

Description

The presentation and storytelling competency is designed to equip students with the essential skills needed to craft compelling narratives and deliver them effectively in various contexts. In today's world, the ability to tell a story and present it persuasively is a critical skill, whether in business, education, media, or personal communication. This module provides a comprehensive exploration of the art and science of storytelling and presentation, blending theoretical knowledge with practical application. Over the course of ten weeks, students will delve into the fundamentals of storytelling, advanced narrative techniques, and the delivery skills necessary to engage and persuade an audience.

Responsible Instructor: Dylan Powell

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
COM-105:00010	Fundamentals of storytelling	Observational assessment	Critical Interpretation : The teacher will observe students ability to critically interpret content by evaluating their analysis, questioning techniques, and understanding of context. This includes assessing how they identify underlying themes, connect ideas, and articulate their insights. The teacher will also consider how students engage with different perspectives, apply reasoning, and support their interpretations with evidence.	Apply	3, 7	3
COM-105:00020	Advanced Storytelling Techniques	Peer assessment	Consolidation of conceptual frame : Students will observe each other's performance in a peer assessment by evaluating how well their colleagues apply learned concepts in a practical presentation. They will assess clarity of understanding, accuracy in application, and effectiveness in problem-solving. Constructive feedback will focus on strengths, areas for improvement, and the ability to integrate and apply knowledge.	Apply	3, 7	3
COM-105:00030	Presentation Skills and Techniques	Hands-on problem	Evidencing Integration of Learning : The teacher will assess students ability to create and deliver presentations by evaluating their approach to solving the task, creativity in generating solutions, and application of learned concepts. The assessment will focus on the originality, coherence, and practicality of the content produced, as well as the student's ability to collaborate, iterate, and refine their work based on feedback and challenges encountered.	Create	3, 7	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.2.6 Details for Competency COM-106

COM-106: Project Management

Identity code: PROJ_MGMT_10

Required? No

Credits: 10 (Graded)

Description

Explore the fundamentals of effective project management in our comprehensive competency. Learn essential skills including planning, scheduling, budgeting, and team leadership to successfully execute projects on time and within budget.

Responsible Instructor: Paisarn Sonthikorn

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
COM-106:00010	Project preparation	Hands-on problem	Understand the definition of project and project management, and the life cycle of project management: Create a context model, stakeholder map, and power-interest matrix	Understand	3	3, 5
COM-106:00020	Project preparation	Hands-on problem	Understand different types of project organizations such as, functional organization, weak/balanced/strong matrix organization, project organization and composite organization: Create a context model, stakeholder map, and power-interest matrix	Understand	3	3, 5
COM-106:00030	Project preparation	Hands-on problem	Understand elements that constitute a coherent project and analyze stakeholders: Create a context model, stakeholder map, and power-interest matrix	Understand	3	3, 5
COM-106:00040	Project planning	Hands-on problem	Systematically plan a project of interest: Systematically plan a project of interest	Apply	3, 7	3
COM-106:00050	Project execution	Hands-on problem	Understand an integrated control system for project execution (including closure): Conduct a short study (no more than three pages) on details and its application of a tool/technique/technology for project execution of interest	Understand	3, 7	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.2.7 Details for Competency COM-108

COM-108: Academic Writing & Research

Identity code: ACADEMIC_WRITING

Required? No

Credits: 8 (Graded)

Description

This 8-credit competency is designed to prepare students interested in the pursuit of graduate-level education through refining the research, sourcing, writing, and critical thinking skills. This competency emphasizes the basic principles of critical reading and research, logic, rhetoric, grammar, writing, and conceptual defense.

This includes critical evaluation, thesis development, data-driven objective analysis, and the typical structure and expectations of academic publishing. This competency demands a well-sourced and well-structured academic thesis as an outcome, which will be assessed directly by an advisor on a one-to-one basis. The student will also be expected to defend this thesis in front of a small faculty panel.

This course will include 4 formal lectures every third week, with one-to-one consultation with the professor for the two weeks between lectures. These one-to-one conversations will be used to develop individual theses, conduct academic research around that thesis, outline the general objectives of the academic paper, and finally to write that paper. As this course has substantial one-to-one advising, there are a limited number of seats available.

Responsible Instructor: Justin Paulsen

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences
- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
COM-108:00010	Logic & Rhetoric	Interview/oral exam	Develop a Thesis: Students will be graded on their clarity of thought in developing this thesis through one-to-one interviews with their professor/advisor.	Apply	3	3
COM-108:00020	Literature reviews including citations and references	Hands-on problem	Academic Research & Literature Review: The assessment will include an ongoing set of quality references which relate to the thesis and form the literature review component of the research paper.	Analyze	3	3
COM-108:00030	Organization of a technical or research document	Hands-on problem	Outline a Research Paper: Students will create an outline of the paper for approval by their advisor or professor.	Create	6	2
COM-108:00040	Units of written language: clauses, sentences and paragraphs	Hands-on problem	Academic Writing for Publication: This thesis paper represents the primary graded portion of the course, and will be the final product.	Create	3	3
COM-108:00050	Logic & Rhetoric	Interview/oral exam	Thesis Defense: This portion is the secondary graded component of the course, and will be a combination of scores provided by the panel.	Apply	3	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.2.8 Details for Competency COM-201

COM-201: Improvisational Acting

Identity code: IMPROV_ACTING_12

Required? No

Credits: 12 (Graded)

Description

This course introduces the fundamentals of improvisational acting, focusing on spontaneity, creativity, and collaboration. Students will develop skills in quick thinking, character creation, and scene work through engaging exercises and live performance practice.

Responsible Instructor: Peevara Kitchumnongpan

Prerequisites

- URD-101 - Undergraduate R&D Project (1)
- URD-102 - Undergraduate R&D Project (2)

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
COM-201:00010	Voice & Actions & Language	Interview/oral exam	<p>Monologue Acting Fundamental: Each student will be assigned or approved a monologue from a play or film.</p> <p>This assignment will be performed in front of other students and instructor in class.</p> <p>A feedback session will be given to student prior to the performance assignment.</p> <p>An Uta Hagen 6 steps notes must be submitted along side your scene</p> <p>An annotated script must submitted</p> <p>Your performance will be filmed for grading and feedback purpose</p>	Create	3	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.2.9 Details for Competency COM-202

COM-202: Instructional Design

Identity code: INSTRUCT_DESIGN_4

Required? No

Credits: 4 (Graded)

Description

A significant portion of the factors influencing a course's effectiveness are determined prior to its commencement. Thoughtful planning during the course design phase not only simplifies and enhances the teaching experience but also promotes effective student learning. Following the course planning stage, teaching primarily involves executing the designed curriculum on a daily basis.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
COM-202:00010	Designing Your Course	Hands-on problem	Assessment: Designing Your Course: Students will analyze a case study of a poorly designed course and identify specific areas where improvements can be made to enhance its effectiveness. They will then propose revised learning objectives for the course, aligning them with the desired outcomes.	Analyze	3	3
COM-202:00020	Teaching Strategies and Classroom Management	Hands-on problem	Assessment: Teaching Strategies and Classroom Management: In groups, students will design a lesson plan for a given topic, incorporating multiple instructional strategies such as lecture, group discussion, and hands-on activities. They will present their lesson plans to the class and receive feedback on the effectiveness and inclusivity of their chosen strategies.	Create	3	3
COM-202:00030	Technology Integration in Education	Quiz or exam	Assessment: Technology Integration in Education: Students will conduct a comparative analysis of two educational technologies, considering factors such as ease of use, accessibility, and alignment with learning objectives. They will present their findings and recommendations to the class, justifying their choice of technology for integration into teaching practices.	Evaluate	3	3
COM-202:00040	Assessment in Teaching and Learning	Hands-on problem	Assessment: Assessment in Teaching and Learning: Working individually, students will develop a comprehensive assessment plan for a hypothetical course, including both formative and summative assessment methods. They will justify their choices based on the course objectives and instructional strategies discussed throughout the module.	Create	3	3
COM-202:00050	Problem-Solving in Teaching	Hands-on problem	Assessment: Problem-Solving in Teaching: Students will engage in a reflective practice exercise where they identify a teaching challenge they have encountered or anticipate encountering. They will then propose research-based strategies to address this challenge, drawing on literature and best practices in the field of education. Finally, they will reflect on how they plan to implement these strategies in their own teaching contexts.	Analyze	3	3
COM-202:00060	Design and Teach a mini-competency/mini-courseworkshop	Interview/oral exam	Assessment: Design and Teach a mini-competency/mini-courseworkshop: Design and deliver a mini-competency/mini-course/workshop for 1 class (1 lecture hr + 1 lab hr) it can be in either - WARP Program - AiCE X-Cellence Camp (Oct 19-20) - Learning Odyssey Program (LOP)	Create	3	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3 ENI Pillar

2.3.1 Details for Competency ENI-101

ENI-101: Create Innovation-driven Enterprise (Path Selection)

Identity code: INNOV_PATH_SELECT_4

Required? Yes

Credits: 4 (Graded)

Description

Create Innovation-driven Enterprise (Path Selection) equips individuals with the strategic foresight and practical skills necessary to navigate diverse pathways in entrepreneurial ventures, fostering innovation-driven leadership and sustainable growth

Responsible Instructor: Dylan Powell

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-101:00010	Innovation-driven Advantage	Imported assessment	Assessment: Contexting Innovation-driven Enterprise: Understand innovation models, sustaining innovation vs. disruptive innovation and how to strategize what to do and not to do so firms can focus on the resource allocation properly.	Analyze	1	1
ENI-101:00030	Innovation-driven Advantage	Imported assessment	Assessment: Componentize Innovation-driven Enterprise: Articulating why innovation is successful or failed while being able to understand how to reduce the odds of failure by adopting systematic innovation approach for their entrepreneurial path.	Analyze	1	1
ENI-101:00040	Entrepreneurial mindset	Imported assessment	Assessment: Choose Entrepreneurial Path: Choose Entrepreneurial Path and Team formation	Evaluate	1	1
ENI-101:00050	Innovation-driven Advantage	Imported assessment	Assessment: Innovation-driven Enterprise Strategy: Understand Innovation Strategy for Startup and Established Firms that student can put into their entrepreneurial path by using tools and framework providing in the class.	Create	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.2 Details for Competency ENI-102

ENI-102: Design Thinking

Identity code: DESIGN_THINKING_4

Required? Yes

Credits: 4 (Graded)

Description

Through hands-on learning, participants will master design thinking for real-world applications. This human-centred approach emphasizes empathy, creativity, and iterative testing. It involves understanding user needs, defining problems, brainstorming ideas, creating prototypes, and refining solutions based on feedback. Encouraging collaboration and diverse perspectives, design thinking fosters continuous improvement, making it invaluable for developing effective, user-friendly solutions in business, education, healthcare, and social impact.

Responsible Instructor: Justin Paulsen

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-102:00010	Concept Definition	Hands-on problem	Inspiration Phase: Develop and present: 1. 1 or 2 Target Personas 2. User Journey and Empathy Map Canvas 3. Customer Profile Canvas, prioritizing the critical Job-to-be-done, pains and gains. At least 3 high-priority jobs must be identified with pains and gains. Pains and Gains must include Functional and Emotional aspects. 4. Create the Ad-lib statements of your solution based on the Customer Profile Canvas in step 3.	Apply	2	2
ENI-102:00020	Concept Definition	Hands-on problem	External Analysis: Conduct a proper strategic analysis of the domain with which your concept will operate. This includes: - PESTEL analysis - Porter's Five Forces - Strategic Positioning Map	Understand	6	2
ENI-102:00030	Ideation	Hands-on problem	Ideation Phase: 1. Develop Value Map for each customer profile and list out solution(s) that can solve pains and create gains; 2. Prototype Your Solution by creating at least two versions; - Use sketch to develop prototyping or software to develop prototype version 1 and review feedback. - Upon feedback, adjust prototype to the version 2. 3. Develop Solution Brochure - To explain your solution features, and how they make gains and/or avoid pains.	Apply	2	2
ENI-102:00040	Prototyping	Hands-on problem	Internal Analysis: Conduct a SWOT analysis of the team building the prototype, including how internal strengths and weaknesses may capture value or encounter external threats (from the External Analyses). Define the competitive advantage being pursued via this prototype, and how it differentiates meaningfully from the competition. Conduct basic budgetary analysis for the overall cost involved in your project, and anticipate revenue over 3 to 5 years using an NPV.	Analyze	2	2
ENI-102:00050	Testing	Hands-on problem	Implementation Phase: Analyze your R&D project so you can develop the scope of your product and implementation plan. You will need to submit the deliverables, including: 1. Functional requirements in the user story format 2. Non-functional requirements to address quality attributes. 3. Product development plan	Apply	2	2
ENI-102:00060	Concept Definition	Hands-on problem	Pitching: The final assessment includes the entire concept, ideally delivered within a 10-minute time frame. Focus on demonstrating desirability, feasibility, and viability through the key phases of design thinking discussed throughout the semester. Consult your previous assignments to demonstrate each step, and how the external factors and internal assessment reinforce your position.	Create	3	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.3 Details for Competency ENI-103

ENI-103: Product Development

Identity code: PRODUCT_DEVELOPMENT_4

Required? No

Credits: 4 (Graded)

Description

Product development competency entails the strategic integration of market research, design thinking, agile methodologies, and cross-functional collaboration to efficiently conceptualize, iterate, and deliver innovative solutions that meet both customer needs and business objectives.

Responsible Instructor: Dylan Powell

Prerequisites

- ENI-102 - Design Thinking

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-103:00010	Viability - Business Case Development	Hands-on problem	Assessing if the product has a real financial use case : Demonstrating the viability of the concepts using meaningful data and insights	Analyze	1	1
ENI-103:00020	Feasibility - Definition	Hands-on problem	Technical development and refinement : demonstrating functionality and concept feasibility	Create	1	1
ENI-103:00030	Scoping	Hands-on problem	Initial definition and assessment of the concept : defined scope, limitation and assumptions with a clear direction for development	Understand	1	1
ENI-103:00040	Desirability - Refinement	Hands-on problem	Refining product-market fit : evidencing a credible design and approach for the commercial offering	Evaluate	1	1
ENI-103:00050	Product Management	Hands-on problem	Designing processes for managing and reviewing product strategy and performance : demonstrate meaningful mechanisms for performance evaluation	Create	1	1
ENI-103:00060	Testing and Validation	Hands-on problem	Verifying key assumptions : Present compelling evidence for the desirability of the offering	Evaluate	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.4 Details for Competency ENI-104

ENI-104: Intellectual Property

Identity code: INTELLECTUAL_PROPERTY.2

Required? No

Credits: 2 (Graded)

Description

Intellectual property competency involves a comprehensive understanding and adept application of legal frameworks, strategic management, and innovative approaches to safeguard and leverage creations, fostering creativity and economic growth.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-104:00010	Understanding intellectual property	Quiz or exam	Understanding the key elements of intellectual property : demonstrating understanding of using contextually based applications	Apply	2	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.5 Details for Competency ENI-105

ENI-105: Startup from Idea to Impact

Identity code: IDEA_TO_IMPACT_12

Required? No

Credits: 6 (Graded)

Description

The Startup from Idea to Impact equips students with the essential skills and knowledge needed to navigate every stage of the startup journey, from concept inception to making a meaningful impact in the market.

Responsible Instructor: Dylan Powell

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-105:00010	How do you scale your business?	Imported assessment	Assessment: Estimate the Total Addressable Market (TAM) Size for Follow-on Markets: This will help team see the magnitude of the revenue potential, which will motivate team to focus on winning the Beachhead Market quickly and effectively so you can branch out into these other markets. Also it forces team to realize that they are doing business not just for the beachhead market but for broader impact.	Analyze	1	1
ENI-105:00020	How do you design and build your product?	Imported assessment	Assessment: Identify key assumptions: While you have tested many key assumptions throughout the 24 Steps, now you have all the elements of the marketing analysis plan, so now it is time to survey the full landscape and identify those key assumptions that are crucial to the overall plan before you begin to make the heavy investments in product development and the supporting infrastructure.	Analyze	1	1
ENI-105:00030	How do you make money of your product?	Imported assessment	Assessment: Design a Business Model: The selection of a value extraction business model can dramatically reduce Cost of Customer Acquisition (COCA), increase Lifetime Value of an Acquired Customer (LTV), and provide team with a competitive advantage. All the information team analyzed will be used for making an informed decision.	Analyze	1	1
ENI-105:00040	What can you do for your customer?	Imported assessment	Assessment: Define your core: Determine the single thing that team will do better than anyone else and very difficult to copy.	Analyze	1	1
ENI-105:00050	Who is your customer?	Imported assessment	Assessment: Market Segmentation and Select Beachhead Market: Understand and apply how to do develop market segmentation and select beachhead market for products/services	Apply	1	1
ENI-105:00060	How does your customers acquire your product?	Imported assessment	Assessment: Determine the Customer's Decision-Making Unit (DMU) and map the Process to Acquire a Paying Customers: Analyze all stakeholders who are involved in making the decision to purchase your product - including influencers. Also, determine how the members of DMU make a decision to buy your product.	Analyze	1	1
ENI-105:00070	What can you do for your customer?	Imported assessment	Assessment: Chart your competitive position: Analyze your product vs customer's alternative options, through the lens of customer's top 2 priorities.	Analyze	1	1
ENI-105:00080	Who is your customer?	Imported assessment	Assessment: Build End-user Profile and Persona: Understand and apply how to build end-user profile and various personas to focus who the product and service will be served	Apply	1	1
ENI-105:00090	How do you design and build your product?	Imported assessment	Assessment: Test key assumptions: This scientific approach will allow you to understand which assumptions are valid, which ones are not, and which ones you can't know for sure yet. As a result, you'll have time to make adjustments to your planning while the cost and time to do so is much less than it will be in the very near future when you launch the product development process.	Analyze	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.6 Details for Competency ENI-106

ENI-106: Building Effective Teams to drive Innovation

Identity code: EFFECTIVE_TEAMS_2

Required? No

Credits: 2 (Graded)

Description

Building Effective Teams is crucial for driving innovation as it fosters collaboration, diversity of thought, and a culture of creativity and experimentation.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-106:00010	Why do the Good Teams fail and then the Great Firms?	Imported assessment	Assessment: Understand and articulate from case studies and why the good teams fail and so impact the great firms.: Take a quiz, written assignment, presentation that evaluates key distinctions and concepts on these topics.	Understand	1	1
ENI-106:00020	The innovator DNA	Imported assessment	Assessment: Understand the DNA of the innovator. Students will start to think further on how to make a good composition of all these DNA in the team: Take a quiz, writtent assignment, presentation that evaluates key distinctions and concepts on these topics.	Understand	1	1
ENI-106:00030	Distributed Leadership	Imported assessment	Assessment: Understand what is essential to having interdisciplinary, distributed leadership in the age of innovation-driven.: Take a quiz, writtent assignment, presentation that evaluates key distinctions and concepts on these topics.	Understand	1	1
ENI-106:00040	Structure the team and make it work.	Imported assessment	Assessment: Understand the practical components that fundamentally begin from the strategic objectives, structure, process, incentive, and culture to achieve the ultimate goals.: Take a quiz, written assignment, presentation that evaluates key distinctions and concepts on these topics.	Understand	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.7 Details for Competency ENI-107

ENI-107: Entrepreneurial finance

Identity code: ENTREPRENEUR_FINANCE_4

Required? No

Credits: 4 (Graded)

Description

Entrepreneurial finance encompasses the skillful navigation of financial strategies tailored to the unique challenges and opportunities of startup ventures, ensuring optimal resource allocation and sustainable growth.

Responsible Instructor: Sampan Nettayanun

Prerequisites

None

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-107:00010	Basic foundation of managing finance for entrepreneur	Imported assessment	Assessment: Understand the basics of financial management from sales projection and create project valuation using FCF and NPV. We will also discuss how startups get investment funding and the different stages of raising funds. Learn from the case study from start to IPO.: Discussion assignment on how startups get investment funding and the different stages of raising funds. Learn from the case study from start to IPO.	Analyze	6	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.8 Details for Competency ENI-408

ENI-408: Game Development & Production

Identity code: GAME_DEVEL_6

Required? No

Credits: 6 (Graded)

Description

Game development and production is the process of creating video games from concept to final release. It involves multiple stages, including designing gameplay mechanics, writing storylines, creating art and sound assets, programming, and testing. This process combines creativity, technical skills, and project management to deliver engaging, interactive experiences across various platforms such as consoles, PCs, and mobile devices.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-408:00020	Games Market Overview: Platforms & Publishers	Quiz or exam	Assessment: Games Market Overview: Platforms & Publishers: Take a quiz that evaluates key concepts	Understand	6, 7	1
ENI-408:00040	Market Analysis Fundamentals	Quiz or exam	Assessment: Market Analysis Fundamentals: Market opportunity analysis and su: Take a quiz that evaluates key concepts	Apply	6, 7	2
ENI-408:00060	Business Planning	Hands-on problem	Assessment: Business Planning Essentials: Funding, development planning, pro: Produce a basic business plan to pitch to the class for a new IP	Apply	6, 7	2
ENI-408:00070	Business Software Production: AGILE & Scrum	Observational assessment	Assessment: Business Production: AGILE, Scrum, multidisciplinary collaborati: Create small teams to begin the execution of the best business plans, and manage those teams towards outcomes.	Apply	2	3, 5
ENI-408:00080	Software Monetization	Observational assessment	Assessment: Modern Monetization: Go-to-market planning for 21st-century game: Add a compelling monetization section to existing business plans, backed by research and analysis from previous lessons.	Analyze	2	3, 5
ENI-408:00090	Localization & Global Distribution	Observational assessment	Assessment: Localization & Global Distribution: Maximizing market size throu: Integrate localization and global distribution requirements into the game development pipeline, including linguistic and legal alterations.	Evaluate	2	3, 5
ENI-408:00110	Gaming Entrepreneurship	Hands-on problem	Assessment: Forming a Studio from Scratch: Gaming Entrepreneurship Fundament: Begin basic conception of the game idea, and translate it into a basic game design document.	Create	2	3, 5
ENI-408:00120	Pitching a Prototype	Hands-on problem	Assessment: Pitching a Prototype: Combining Analysis with Execution: Present the business plan and basic design documentation to the class for critique.	Create	2, 3	3, 5

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.9 Details for Competency ENI-409

ENI-409: Game content Monetization and Tokenomics

Identity code: GAME.ECONOMY_4

Required? No

Credits: 4 (Graded)

Description

Game content monetisation and tokenomics involve generating revenue from in-game assets and experiences using digital tokens. Monetization strategies include in-app purchases, subscriptions, and advertising. Tokenomics refers to the economic system governing the creation, distribution, and management of digital tokens within a game, often leveraging blockchain technology. These tokens can represent in-game currency, assets, or collectibles that players can buy, sell, or trade. Effective tokenomics ensures a balanced and sustainable economy, incentivizing player engagement and investment. This approach allows developers to create new revenue streams while enhancing player experience through ownership and trading of unique digital assets.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-409:00020	Games Market Overview: Platforms & Publishers	Quiz or exam	Assessment: Games Market Overview: Platforms & Publishers: Take a quiz that evaluates key concepts	Understand	6, 7	1
ENI-409:00040	Market Analysis Fundamentals	Quiz or exam	Assessment: Market Analysis Fundamentals: Market opportunity analysis and su: Take a quiz that evaluates key concepts	Apply	6, 7	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.10 Details for Competency ENI-410

ENI-410: E-Sports & Ecosystem Development

Identity code: ESPORTS_4

Required? No

Credits: 4 (Graded)

Description

Esports and ecosystem development involve the organised competitive play of video games at a professional level, supported by a robust infrastructure. This ecosystem encompasses players, teams, tournaments, sponsors, broadcasters, and fans. Key elements include organizing leagues, tournaments, and events, cultivating player talent through training and coaching, and building fan engagement through livestreaming and media coverage. Sponsorships, advertising, and merchandise sales drive revenue, while platforms like Twitch and YouTube Gaming provide global reach. Ecosystem development focuses on sustaining growth, enhancing infrastructure, and fostering community participation to elevate esports into a mainstream entertainment industry with a dedicated fanbase and substantial economic impact.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Core Technical

Skills and Assessments None specified.

2.3.11 Details for Competency ENI-411

ENI-411: Game Publishing and Marketing

Identity code: GAME_PUBLISHING_4

Required? No

Credits: 4 (Graded)

Option Group: Business Application Domains

Description

Game publishing and marketing involve the strategic promotion and distribution of video games to maximize visibility, reach, and sales. Publishers handle various aspects, including funding development, coordinating production, and managing distribution across platforms. Marketing strategies encompass creating compelling trailers, advertisements, and social media campaigns to build anticipation and attract players. Publishers collaborate with developers to ensure games meet market expectations and leverage existing fanbases. Effective marketing identifies target audiences, optimizes visibility on digital storefronts, and cultivates community engagement through events and influencer partnerships. Together, publishing and marketing play critical roles in launching successful games and sustaining long-term player interest.

Responsible Instructor: Justin Paulsen

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-411:00030	Market Analysis Fundamentals	Hands-on problem	Assessment: Market Analysis Fundamentals: Market opportunity analysis and su: Integrate well-sourced statistics and research to support and persuade investors towards a new IP concept.	Apply	6, 7	2
ENI-411:00050	Software Monetization	Hands-on problem	Assessment: Modern Monetization: Go-to-market planning for 21st-century game: Add a compelling monetization section to existing business plans, backed by research and analysis from previous lessons.	Analyze	2, 3	3, 5
ENI-411:00070	Gaming Entrepreneurship	Hands-on problem	Assessment: Forming a Studio from Scratch: Gaming Entrepreneurship Fundament: Begin basic conception of the game idea, and translate it into a basic game design document.	Create	3, 5	2, 3
ENI-411:00080	Pitching a Prototype	Hands-on problem	Concept Pitching & Planning: Present the business plan and basic design documentation to the class for critique.	Create	3, 5	2, 3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.12 Details for Competency ENI-201

ENI-201: Strategic Innovation Development

Identity code: INNOV_DEVEL_4

Required? No

Credits: 4 (Graded)

Description

Competency in strategic innovation development involves navigating complex market landscapes, harnessing emerging technologies, and fostering a culture of creativity to drive sustainable growth and competitive advantage.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-201:00010	Strategic development of firm innovation.	Imported assessment	Assessment: Understand different types of innovations and examples of how the firm builds and foster the Innovation portfolio. Learn from examples by articulating how innovative firms create a source of differentiation while diversifying the sum of all its parts.: Take a quiz, written assignment, presentation that evaluates key distinctions and concepts on these topics.	Understand	2	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.13 Details for Competency ENI-202

ENI-202: Business Strategy

Identity code: BUS_STRATEGY_2

Required? No

Credits: 2 (Graded)

Description

Strategy is the art of decision-making, and the tactical application of resources in pursuit of realizing these decisions in the real-world.

Therefore - strategists are team members on projects who are equipped to take accountability for the direction of a project from conception to launch. While there are tools, methods, models, and knowledge which can support the creation and implementation of strategy, it's the character of leadership that will be the primary learning objective in this course.

As a 2-credit competency, the course requirements will be limited to the following: - 4 lectures (3 from the professor, and one guest speaker) - 2 case studies, which will require a comprehensive analysis and final strategic recommendation by each student (or student team, depending on class size) - 1 strategic plan for an existing project (URD project or personal business initiative)

Responsible Instructor: Justin Paulsen

Prerequisites

None

Distribution Areas

- Core Technical
- Humanities and Social Sciences
- Soft Skills

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-202:00010	Planning for strategic change	Hands-on problem	Assess existing organizational environments: Case study analysis, identifying issues within an organization and prescribing executive intervention towards strategic change.	Understand	1	1
ENI-202:00020	Planning for strategic change	Hands-on problem	Develop strategic recommendations: Review a case study with clearly defined problems, and provide strategic recommendations which are actionable, accountable, and effective within the context of the information provided.	Apply	3, 5	3, 5
ENI-202:00030	Planning for strategic change	Hands-on problem	Execute a strategic plan: This will move from a case study approach to a real-life application, where students are expected to apply knowledge towards URD projects and/or independent initiatives in pursuit of strategic objectives.	Create	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.14 Details for Competency ENI-203

ENI-203: Platform Strategy

Identity code: PLATFORM_STRATEGY_4

Required? No

Credits: 4 (Graded)

Description

This competency equips you with a deep understanding of platform businesses, including their functions and core principles. You'll learn to conceptualize, research, analyze, and develop a comprehensive business plan for your own platform. Whether you aspire to create your own platform or build a product strategy, this competency will broaden your business acumen and provide a holistic view of organizational success. test

Responsible Instructor: Piyamin Trithipcharoenchai

Prerequisites

None

Distribution Areas

- Core Technical
- R&D
- Soft Skills

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-203:00010	Steps to building a successful Platform	Imported assessment	Understand Platform and Business: Take a quiz, written assignment, presentation that evaluates key distinctions and concepts on these topics.	Understand	2	2, 5
ENI-203:00020	Steps to building a successful Platform	Imported assessment	Apply knowledge to transform traditional business to Platform business: Individual assignment / Group assignment	Analyze	2, 3, 7	2, 3
ENI-203:00030	Steps to building a successful Platform	Imported assessment	Create Platform Strategy: Group assignment	Create	2, 3, 5, 7	2, 3, 5

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.15 Details for Competency ENI-304

ENI-304: AI for Business

Identity code: ALFOR.BUS.12

Required? No

Credits: 12 (Graded)

Description

AI is a transformative tool for businesses, leveraging data-driven insights and automation to enhance decision-making, optimize operations, and drive sustainable growth.

Responsible Instructor: UNSPECIFIED

Prerequisites

- AIC-201 - Supervised Learning and Unsupervised Learning
- ENI-201 - Strategic Innovation Development
- ENI-202 - Business Strategy

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-304:00010	Ai for Business	Imported assessment	Assessment: Ai for Business: Create Ai for Business plan	Analyze	2	2
Category		Code	Learning Outcome			
Engineering SLO		1	Engineering problem solving			
		2	Designing to meet requirements			
		3	Effective communication			
		4	Ethical awareness			
		5	Teamwork			
		6	Experimental design and data analysis			
		7	Self-learning			
Computing SLO		1	Computational problem solving			
		2	Designing, implementing and evaluating from requirements			
		3	Effective communication			
		4	Ethical and professional awareness			
		5	Teamwork			

2.3.16 Details for Competency ENI-301

ENI-301: Inclusive Leadership

Identity code: LEADERSHIP_2

Required? No

Credits: 2 (Graded)

Description

Inclusive leadership fosters an environment where diverse perspectives are not only welcomed but actively sought, resulting in a cohesive and innovative team culture.

Responsible Instructor: Sorakrit Phruthanontachai

Prerequisites

- ENI-202 - Business Strategy
- ENI-201 - Strategic Innovation Development

Distribution Areas

- Core Technical
- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-301:00010	Introduction to Strategic Leadership Communication and Negotiation	Imported assessment	Assessment: Understand why Negotiation is an important matter for their career either within the corporates or their own startup ventures.: Given short role play	Understand	3, 5	3, 5
ENI-301:00020	Introduction to Inclusive Leadership	Imported assessment	Assessment: Students will finish this class with the fundamentals of how to lead, and communicate with diverse teams more effectively.: Given leadership test	Understand	3, 4, 5	3, 4, 5
ENI-301:00030	Putting it all together	Imported assessment	Assessment: Understand being the future leader who can communicate strategically and effectively while being able to deliver persuasive and systematic negotiation.: Given communication strategical and deliver persuasive negotiation test	Understand	3, 4, 5	3, 4, 5

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.17 Details for Competency ENI-302

ENI-302: Persuasive and Leadership Communication

Identity code: PERSUASIVE_COM_4

Required? No

Credits: 4 (Graded)

Description

Persuasive and leadership communication fosters influential dialogue, inspiring others to action through compelling rhetoric and decisive guidance.

Responsible Instructor: Sorakrit Phruthanontachai

Prerequisites

- ENI-201 - Strategic Innovation Development
- ENI-202 - Business Strategy

Distribution Areas

- Core Technical
- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-302:00010	Persuasive Communication	Imported assessment	Assessment: Understand how to communicate strategically, building persuasive message structure and increase ability to motivate, influence audience to action.: Given speech test	Understand	3	3
ENI-302:00020	Communicating with Data	Imported assessment	Assessment: Understand how to convey the message and communicate to others.: Given data and convey the message test	Understand	1, 3	1, 3
ENI-302:00030	Communicating Persuasively by Listening, and through giving and receiving feedback	Imported assessment	Assessment: Understand how to be an active and reflective listener.: Given listening and reflecting message test	Understand	3	3
ENI-302:00040	Communicating Persuasively with Presentations	Imported assessment	Assessment: be able to give an effective and persuasive presentation.: give a presentation test	Apply	3	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.18 Details for Competency ENI-303

ENI-303: Negotiation

Identity code: NEGOTIATION_4

Required? No

Credits: 4 (Graded)

Description

Competency in negotiation entails the adept ability to navigate diverse perspectives, cultivate collaborative solutions, and effectively advocate for one’s interests while fostering mutual understanding and respect.

Responsible Instructor: Sorakrit Phruthanontachai

Prerequisites

- ENI-201 - Strategic Innovation Development
- ENI-202 - Business Strategy

Distribution Areas

- Core Technical
- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-303:00010	Core Negotiation Strategy	Imported assessment	Assessment: Understand the principles of influence and bargaining practice.: Given bargaining test practice.	Understand	1, 3	1, 3
ENI-303:00020	Psychology of Negotiation	Imported assessment	Assessment: Understand the psychology of Negotiation practical tools, try to avoid the mistakes, and recognize and leverage mistakes.: Given psychology of Negotiation test	Understand	3, 5	3, 5
ENI-303:00030	Investigative Negotiation	Imported assessment	Assessment: Understand the approach to “investigative negotiation.”: Given Investigative Negotiation test	Understand	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.19 Details for Competency ENI-401

ENI-401: Retail and Services Applications

Identity code: RETAIL_APPL_4

Required? No

Credits: 4 (Graded)

Option Group: Business Application Domains

Description

All AiCE students must complete at least one Business Application Domain (B.A.D.) to obtain insights into high-opportunity industries and gain hands-on experience applying their technical knowledge within real-world and industry-specific contexts.

The Business Application Domain offers participants an industry domain to choose from while engaging in a research project.

The project is designed to offer the participants an informative understanding of the essential knowledge areas which comprise the industry.

Throughout the project, students will develop a Market Analysis Report and Strategic Proposal while engaging in secondary and primary research within the industry.

Each B.A.D. is offered in coordination with a sponsor organisation, after the project students can present their findings and recommendations to the sponsor as an opportunity to gain practical feedback while allowing students to showcase their talents to a potential future employer.

Students interested in domains outside of the current offering can contact: dylan@cmkl.ac.uk and we will consider these requests.

Responsible Instructor: Dylan Powell

Prerequisites

- ENI-101 - Create Innovation-driven Enterprise (Path Selection)
- ENI-102 - Design Thinking
- URD-101 - Undergraduate R&D Project (1)
- URD-102 - Undergraduate R&D Project (2)

Distribution Areas

- Core Technical
- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-401:00010	Introduction and exploration of the retail industry	Hands-on problem	Research Investigation : Insight Development: Identifying patterns, trends, and insights from research that are relevant to the business domain. Comparative Analysis: Comparing multiple sources to highlight consistencies, contradictions, and gaps in information. Contextual Understanding: Linking secondary data to real-world business challenges and opportunities.	Analyze	2	2
ENI-401:00030	Strategic Proposal	Hands-on problem	Formation of Critical Insights : Unique Perspectives: Offering original insights or interpretations based on the data. Strategic Recommendations: Develop actionable recommendations that stem from the research findings. Innovation: Proposing creative solutions or approaches to leveraging the insights in the business domain.	Create	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.20 Details for Competency ENI-402

ENI-402: Logistics

Identity code: LOGISTICS_APPL_4

Required? No

Credits: 4 (Graded)

Option Group: Business Application Domains

Description

The Business Application Domain offers participants an industry domain to choose from to engage in a research project. The project will provide the participants with a broad understanding of their selected industry. The aim of this competency is to capture the essence of the domain which has been selected. The project is designed to offer the participants an informative understanding of the essential knowledge areas which comprise the industry. Over the course of the project, students will develop a Market Analysis Report while engaging in secondary and primary research within the industry. At the conclusion of the project, students will have the opportunity to present their findings and recommendations to a sponsor representing a leading industry within the sector.

Responsible Instructor: UNSPECIFIED

Prerequisites

- ENI-101 - Create Innovation-driven Enterprise (Path Selection)
- ENI-102 - Design Thinking
- URD-101 - Undergraduate R&D Project (1)
- URD-102 - Undergraduate R&D Project (2)

Distribution Areas

- Core Technical
- R&D

Skills and Assessments None specified.

2.3.21 Details for Competency ENI-403

ENI-403: Biomedical, Bioinformatics and Health

Identity code: BIOMED_APPL_4

Required? No

Credits: 4 (Graded)

Option Group: Business Application Domains

Description

The Business Application Domain offers participants an industry domain to choose from to engage in a research project. The project will provide the participants with a broad understanding of their selected industry. The aim of this competency is to capture the essence of the domain which has been selected. The project is designed to offer the participants an informative understanding of the essential knowledge areas which comprise the industry. Over the course of the project, students will develop a Market Analysis Report while engaging in secondary and primary research within the industry. At the conclusion of the project, students will have the opportunity to present their findings and recommendations to a sponsor representing a leading industry within the sector.

Responsible Instructor: UNSPECIFIED

Prerequisites

- ENI-101 - Create Innovation-driven Enterprise (Path Selection)
- ENI-102 - Design Thinking
- URD-101 - Undergraduate R&D Project (1)
- URD-102 - Undergraduate R&D Project (2)

Distribution Areas

- Core Technical
- R&D

Skills and Assessments None specified.

2.3.22 Details for Competency ENI-404

ENI-404: Agriculture

Identity code: AGRO_APPL4

Required? No

Credits: 4 (Graded)

Option Group: Business Application Domains

Description

The Business Application Domain offers participants an industry domain to choose from to engage in a research project. The project will provide the participants with a broad understanding of their selected industry. The aim of this competency is to capture the essence of the domain which has been selected. The project is designed to offer the participants an informative understanding of the essential knowledge areas which comprise the industry. Over the course of the project, students will develop a Market Analysis Report while engaging in secondary and primary research within the industry. At the conclusion of the project, students will have the opportunity to present their findings and recommendations to a sponsor representing a leading industry within the sector.

Responsible Instructor: UNSPECIFIED

Prerequisites

- ENI-101 - Create Innovation-driven Enterprise (Path Selection)
- ENI-102 - Design Thinking
- URD-101 - Undergraduate R&D Project (1)
- URD-102 - Undergraduate R&D Project (2)

Distribution Areas

- Core Technical
- R&D

Skills and Assessments None specified.

2.3.23 Details for Competency ENI-405

ENI-405: Fintech

Identity code: FINTECH_APPL_4

Required? No

Credits: 4 (Graded)

Option Group: Business Application Domains

Description

The Business Application Domain offers participants an industry domain to choose from to engage in a research project. The project will provide the participants with a broad understanding of their selected industry. The aim of this competency is to capture the essence of the domain which has been selected. The project is designed to offer the participants an informative understanding of the essential knowledge areas which comprise the industry. Over the course of the project, students will develop a Market Analysis Report while engaging in secondary and primary research within the industry. At the conclusion of the project, students will have the opportunity to present their findings and recommendations to a sponsor representing a leading industry within the sector.

Responsible Instructor: Sorakrit Phruthanontachai

Prerequisites

- ENI-101 - Create Innovation-driven Enterprise (Path Selection)
- ENI-102 - Design Thinking
- URD-101 - Undergraduate R&D Project (1)
- URD-102 - Undergraduate R&D Project (2)

Distribution Areas

- Core Technical
- Math/Science
- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-405:00010	FinTech Business Model	Hands-on problem	Analyzing FinTech Applications and Business Model: Analyzing FinTech Applications using a recognized tool such as the Business Model Canvas. Students should provide an assessment and evaluation of the current business model of real FinTech companies, such as TrueMoney and Stripe. The assessment will allow students to gain a comprehensive understanding of business models that enable FinTech to prosper in the real world. Additionally, the assessment will equip students with a foundational understanding to help them create their own FinTech strategy and business model. This not only provides a firm foundation in FinTech analysis but also encourages students to apply their knowledge, think critically, and develop their own innovative strategies.	Analyze	None	2, 5
ENI-405:00020	FinTech Business Model	Hands-on problem	Enhancing FinTech Business Model using AI Technology: Enhance the business model that FinTech students analyzed in the previous assessment. Thoroughly analyze and evaluate AI technologies that can help the FinTech firm improve customer experience, optimize operations, and/or identify new business models. This assessment requires students to apply AI technologies they have learned in the program, or from new research, and endeavor to apply AI to elevate the business model to the next level.	Evaluate	2, 5	2, 5
ENI-405:00030	FinTech Product Strategy	Hands-on problem	Build your own FinTech, Building Strategic Vision and Business Opportunity using Problem Discovery: This assessment will require students to formate Strategic Vision: A clear and compelling strategic vision is essential for guiding your FinTech venture. This vision should articulate your long-term goals, target market, and the unique value students aim to deliver. Business Opportunity Identification: Identifying a viable business opportunity requires a deep understanding of the market and customer needs. This involves conducting market research, analyzing competitor offerings, and identifying gaps in the market. Problem Discovery: The problem discovery process is crucial for uncovering unmet customer needs and pain points. This involves engaging with potential customers, observing qualitatively, conducting surveys, and analyzing market trends. Students can find the right problems to solve which later will use as value creation hypothesis to help ideate and develop solutions that truly resonate with your target audience.	Create	2, 5	2, 5
ENI-405:00040	FinTech solution-market fit	Hands-on problem	Build your own FinTech, Ideate Technical Solutions to build FinTech and address Technical Feasibility: By carefully following a structured approach, students can increase thier chances	Create	1, 2, 5	2, 5

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.24 Details for Competency ENI-406

ENI-406: Educational Technology

Identity code: ED_TECH_APPL_4

Required? No

Credits: 4 (Graded)

Option Group: Business Application Domains

Description

This course provides participants with a comprehensive understanding of the Educational Technology (EdTech) industry, including its foundational principles, technological innovations, and real-world applications. Participants will engage with industry experts, explore case studies, and develop actionable insights through hands-on projects. By the end of the course, students will gain a deeper appreciation of how to scale EdTech solutions and effectively apply theoretical frameworks in practical contexts.

Responsible Instructor: Apirujee Rujirek

Prerequisites

- ENI-101 - Create Innovation-driven Enterprise (Path Selection)
- ENI-102 - Design Thinking
- URD-101 - Undergraduate R&D Project (1)
- URD-102 - Undergraduate R&D Project (2)

Distribution Areas

- Core Technical
- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-406:00010	Introduction to the Educational Technology Industry	Hands-on problem	Understand Overview of the EdTech Market: Pick and Examine a successful EdTech startup and their market impact and write a report about it. (Industry Overview, Market Analysis, Technological Advances, Regulatory Environment, Economic Impact, Challenges and Opportunities, Future Outlook)	Analyze	7	None
ENI-406:00020	Technological Innovations in EdTech (TPCK framework)	Hands-on problem	Applying the TPACK Framework to Develop a Course in AI Engineering: In this assignment, you will apply the TPACK (Technological, Pedagogical, and Content Knowledge) framework to design an innovative course for the AI Engineering program, incorporating cutting-edge educational technologies and digital tools. Your task is to conceptualize a course that leverages technology to enhance learning outcomes, engagement, and instructional effectiveness. The goal is to develop a course that integrates content knowledge (AI engineering concepts), pedagogy (effective teaching strategies), and technology (EdTech tools) seamlessly.	Apply	2	2
ENI-406:00030	Implementation and Scaling of EdTech Solutions	Hands-on problem	Apply the Scaling approach for EdTech Products: Create a scaling strategy and pitch deck for a start-up EdTech company looking to expand globally. We will use 'Canarie' and 'AICE' as case studies. The deck should include the followings; - What you do (Keep it short and sweet) - Problem & Solution (What current problem(s) are you solving with your product/prohect?) - Value proposition (What value are you bringing to the table?) - Business Model (how will you make money from it?) - Financials and forecast (optional - feel free to include for extra credit) - Potential market size (If your work is not scalable then potential market size is fine) - Growth plan (if it is not scalable, what is the potential for continuation and how would it be sustainable?) - Competition (who's already in the market and how do you differentiate yourself from them)	Apply	6	4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.3.25 Details for Competency ENI-407

ENI-407: Gaming

Identity code: GAMING_4

Required? No

Credits: 4 (Graded)

Option Group: Business Application Domains

Description

The gaming industry is both highly competitive and highly fragmented, with genuine opportunity for small teams to build and maintain a successful position within the industry and produce/publish content.

The purpose of this competency is therefore to:

1.) Satisfy the Business Application Domain requirement at CMKL, allowing technical experts in AiCE to gain a solid foundation in (at least) one industry; 2.) Learn from existing players in the industry in a hands-on and immersive way, gaining insights into the complexities of managing these production pipelines; and, 3.) Derive a solid strategy to establish our own successful indie studios and studio projects at CMKL, with external, competitive, and internal analyses of the industry in mind.

The ideal student for this competency has an interest in interactive digital media development, and is considering game design, development, engineering, and publishing as a potential professional ambition.

Responsible Instructor: Justin Paulsen

Prerequisites

- ENI-101 - Create Innovation-driven Enterprise (Path Selection)
- ENI-102 - Design Thinking
- URD-101 - Undergraduate R&D Project (1)

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
ENI-407:00010	Gaming Industry Fundamentals	Hands-on problem	Industry analysis: This analysis will be one of three parts of the broader deliverable, which is a complete strategic analysis of the gaming industry from the perspective of an incumbent in that industry (a local Thai studio and/or publisher).	Analyze	3, 7	3
ENI-407:00020	Gaming Industry Operations	Hands-on problem	Internal Analysis: This analysis will be one of three parts of the broader deliverable, which is a complete strategic analysis of the gaming industry from the perspective of an incumbent in that industry (a local Thai studio and/or publisher).	Analyze	3, 7	3
ENI-407:00030	Strategic Analysis	Hands-on problem	Strategic Analysis: This analysis will be one of three parts of the broader deliverable, which is a complete strategic analysis of the gaming industry from the perspective of an incumbent in that industry (a local Thai studio and/or publisher).	Evaluate	3, 7	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.4 HAS Pillar

2.4.1 Details for Competency HAS-101

HAS-101: Sociology and Cultural Anthropology

Identity code: ANTHROPOLOGY_9

Required? No

Credits: 9 (Graded)

Description

This competency provides a comprehensive exploration of sociological and cultural anthropological theories, concepts, and methods. Students will examine key theories explaining social structures, institutions, and behaviors, and apply them to analyze contemporary social issues. Topics include the study of social institutions, cultural diversity, and ethnographic research methods. Through critical evaluation and comparative analysis, students will develop a deeper understanding of how societies function, change, and interact globally. This course fosters critical thinking skills and prepares students to engage with complex social and cultural dynamics in diverse contexts.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HAS-101:00010	Classical and Contemporary Sociological Theories	Quiz or exam	Understanding of Sociological Theories and Concepts: Short-answer exams evaluating knowledge and application of foundational sociological theories and concepts.	Understand	4	4
HAS-101:00020	Social Institutions	Imported assessment	Analysis of Social Institutions and Processes: Essays that require students to analyze the role and functioning of social institutions and processes.	Analyze	4	4
HAS-101:00030	Current Social Issues	Imported assessment	Critical Evaluation of Contemporary Social Issues: Essays analyzing contemporary social issues using critical thinking and diverse perspectives.	Create	4	4
HAS-101:00040	Cultural Diversity and Ethnographic Research	Quiz or exam	Understanding of Cultural Anthropological Concepts and Methods: Short-answer exams assessing knowledge of cultural anthropological concepts and methods.	Understand	4	4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.4.2 Details for Competency HAS-102

HAS-102: Social Psychology

Identity code: SOCIAL_PSYCH_9

Required? No

Credits: 9 (Graded)

Description

This course will explore how people's behaviors, feelings, and thoughts are influenced by their social environment. It will start with lectures and readings on the methods social psychologists use to study social behavior. The competency will then cover a range of topics researched by social psychologists, including person perception, prejudice and discrimination, the nature of attitudes and their formation and change, interpersonal attraction, conformity, compliance, altruism, aggression, group behavior, and the application of psychology to issues in health care, law, politics, and the environment. Students will also be introduced to social psychological theories through these readings and lectures.

Responsible Instructor: Sovaritthon Chansaengsee

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HAS-102:00010	Critical evaluation of social psychological theories	Imported assessment	Critical Thinking and Enthusiasm: Essays reflecting critical thinking, curiosity, and enthusiasm for the field of social psychology, drawing on course material and personal insights.	Analyze	None	None
HAS-102:00020	Cross-cultural variations in social behavior	Imported assessment	Cultural Context Understanding: Essays that demonstrate an understanding of how social psychological theories apply to human behavior across different cultural contexts.	Understand	None	None
HAS-102:00030	Milgram's obedience study	Quiz or exam	Familiarity with Landmark and Contemporary Studies: Short-answer exams testing knowledge of landmark studies and contemporary research questions in social psychology.	Understand	None	None
HAS-102:00040	Research design and methodology	Imported assessment	Scientific Method Application: Essays that require students to explain human behavior using scientific methods and evidence from social psychological research.	Understand	None	None
HAS-102:00050	Social cognition and perception	Quiz or exam	Understanding of Foundational Theories and Concepts: Short-answer exams evaluating knowledge and application of foundational theories and concepts of social psychology.	Evaluate	None	None
HAS-102:00060	Social influence and persuasion	Quiz or exam	Recognition of Social Psychological Processes: Short-answer exams assessing the ability to describe and distinguish social psychological processes in everyday life.	Understand	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.4.3 Details for Competency HAS-103

HAS-103: Political Studies

Identity code: POLITICS_9

Required? No

Credits: 9 (Graded)

Description

This competency explores fundamental political concepts such as power, equality, sustainability, and peace in a range of contexts and at a variety of levels.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HAS-103:00010	Classical and contemporary political ideologies	Quiz or exam	Understanding of Political Theories and Concepts: Short-answer exams evaluating knowledge and application of foundational political theories and concepts.	Understand	4	4
HAS-103:00020	The structure and role of government branches (executive, legisl	Imported assessment	Analysis of Political Institutions and Processes: Essays that require students to analyze the role and functioning of political institutions and processes.	Analyze	4	4
HAS-103:00030	Current global political issues and conflicts	Imported assessment	Critical Evaluation of Political Events and Issues: Essays analyzing contemporary political events and issues using critical thinking and diverse perspectives.	Evaluate	4	4
HAS-103:00040	Comparative analysis of democratic and authoritarian regimes	Quiz or exam	Understanding of Comparative Politics and International Relations: Short-answer exams assessing knowledge of comparative politics and international relations.	Understand	4	4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.4.4 Details for Competency HAS-104

HAS-104: Human Geography

Identity code: HUM.GEOGRAPHY_9

Required? No

Credits: 9 (Graded)

Description

Explore the dynamic relationship between human societies and the natural environment in this comprehensive Human Geography course. Students will delve into spatial analysis using Geographic Information Systems (GIS), examine cultural and social landscapes, analyze economic globalization, and investigate environmental sustainability challenges. Through interdisciplinary approaches and case studies, students will gain insights into how geographic factors shape societies, economies, and environments globally. This course prepares students to critically assess and address complex geographical issues facing our interconnected world today.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HAS-104:00010	Spatial Patterns and Processes	Imported assessment	Spatial Analysis and Geographic Information Systems (GIS): Practical exercises and projects applying GIS to analyze geographic data and spatial phenomena.	Analyze	6	2
HAS-104:00020	Cultural Landscapes and Identity	Imported assessment	Cultural and Social Geography: Essays and presentations examining cultural landscapes and social geography issues.	Understand	4	4
HAS-104:00030	Global Economic Systems and Development	Imported assessment	Economic Geography and Globalization: Case studies and research papers on economic geography topics.	Analyze	4	4
HAS-104:00040	Environmental Change and Resilience	Imported assessment	Environmental Geography and Sustainability: Projects and reports evaluating environmental issues and sustainability solutions.	Evaluate	4	4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.4.5 Details for Competency HAS-105

HAS-105: Global Histories

Identity code: GLOBAL.HISTORIES_9

Required? No

Credits: 9 (Graded)

Description

This course provides a comprehensive exploration of global historical events, movements, and processes from ancient times to the present. Students will engage with foundational historical theories and methodologies to analyze and compare significant historical phenomena across different regions and periods. Topics include the study of empires and colonialism, revolutions and social movements, and global trade networks and cultural exchanges. Through critical evaluation and comparative analysis, students will gain a deeper understanding of how historical events have shaped the interconnected world we live in today. This course fosters critical thinking and historical awareness, preparing students to engage with complex global historical issues.

Responsible Instructor: Dylan Powell

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HAS-105:00010	The History of Human Technological Development	Hands-on problem	Narrative based historical analysis : A documentary exploring a course-related historical topic. Students must combine storytelling, academic analysis, and multimedia elements to present a balanced narrative. Clear organization, high-quality visuals, and audio are essential. Evaluation emphasizes content depth, engagement, structure, technical quality, and integration of credible, properly cited sources.	Create	6	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.4.6 Details for Competency HAS-109

HAS-109: Ethics and Policy Issues

Identity code: ETHICS.POLICY.2

Required? No

Credits: 2 (Graded)

Description

This competency provides an exploration of the intersection between ethics and public policy, focusing on how ethical theories and frameworks can be applied to analyze and resolve policy issues. Students will engage with foundational ethical theories and methodologies to evaluate contemporary policy debates and their moral implications.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HAS-109:00010	Utilitarianism, Deontology, and Virtue Ethics	Quiz or exam	Understanding Ethical Theories and Frameworks: Short-answer exams evaluating knowledge and application of ethical theories and frameworks.	Understand	4	4
HAS-109:00020	Healthcare Policy and Bioethics	Imported assessment	Analysis of Policy Issues and Ethical Implications: Essays that require students to analyze policy issues and assess their ethical dimensions.	Analyze	4	4
HAS-109:00030	Environmental Ethics and Sustainability	Imported assessment	Critical Evaluation of Public Policies: Essays evaluating public policies using critical thinking and diverse ethical perspectives.	Evaluate	4	4
HAS-109:00040	Global Justice and Human Rights	Quiz or exam	Understanding Global and Cultural Perspectives on Ethics: Short-answer exams assessing knowledge of global and cultural ethical perspectives.	Understand	4	4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.4.7 Details for Competency HAS-110

HAS-110: Policy & Sustainable Development

Identity code: SDG_6

Required? No

Credits: 6 (Graded)

Description

No description provided

Responsible Instructor: Buraskorn Torut

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HAS-110:00010	Foundations of Policy and Sustainable Development	Quiz or exam	Understanding Foundations of Policy and Sustainable Development: Multiple-choice questions on the SDGs and core public policy theories (assessing understanding of foundational concepts).	Understand	4	4
HAS-110:00020	Policy Design and Implementation for Sustainability	Imported assessment	Designing policies that address sustainability challenges: Policy Design Proposal: Develop a policy proposal addressing a sustainability issue, incorporating stakeholder engagement and monitoring strategies (assessing policy design skills).	Analyze	4	4
HAS-110:00030	Economic, Environmental, and Social Dimensions of Sustainability	Imported assessment	Analyzing the economic aspects of environmental sustainability: Case Study Analysis: Analyze a real-world case where economic, environmental, and social factors were considered in a sustainable development policy (assessing the ability to integrate diverse sustainability dimensions).	Analyze	4	4
HAS-110:00040	International Policy and Sustainable Development Governance	Imported assessment	Understanding the role of international agreements in sustainable development: International Policy Report: Write a report evaluating the effectiveness of an international agreement (e.g., the Paris Agreement) in advancing sustainability (assessing understanding of international governance and policy coherence).	Evaluate	3, 4	3, 4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.4.8 Details for Competency HAS-113

HAS-113: AI and Computer Engineering for Community Impact I

Identity code: AI-COMMUNITY_1.4

Required? No

Credits: 4 (Graded)

Description

This competency offers students a unique opportunity to apply their knowledge of AI and computer engineering in real-world community settings. Throughout the time, students will engage in hands-on projects and community service activities designed to address specific needs within local communities. The course emphasizes experiential learning, fostering practical skills, social responsibility, and a deeper understanding of the societal impacts of technology. Term: Spring (during Winter Break) Location: Varied (local community sites) Format: On-site, activities-based, no lecture

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HAS-113:00010	Community Engagement and Applied AI for Social Impact	Self-assessment	Apply AI and computer engineering concepts to real-world community problems.: Attendance (50%): Active participation and engagement in all on-site activities are crucial. Students are expected to be present, punctual, and fully involved in their assigned projects. Individual Essay (50%): Each student must submit a reflective essay (500-1000 words) that discusses their experiences, the impact of their work on the community, and personal growth. The essay should include specific examples and insights gained from the course activities.	Evaluate	3, 4, 5	3, 4, 5

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.4.9 Details for Competency HAS-123

HAS-123: AI and Computer Engineering for Community Impact II

Identity code: ALCOMMUNITY_2.4

Required? No

Credits: 4 (Graded)

Description

This competency offers students a unique opportunity to apply their knowledge of AI and computer engineering in real-world community settings. Throughout the time, students will engage in hands-on projects and community service activities designed to address specific needs within local communities. The course emphasizes experiential learning, fostering practical skills, social responsibility, and a deeper understanding of the societal impacts of technology. Term: Spring (during Winter Break) Location: Varied (local community sites) Format: On-site, activities-based, no lecture Spring 2025

Highlight activities: Chiang Mai Univ. Engineering Lab Visit AI and Computer Engineering for Community Impact with Stray Dog Foundation Community service Ecosystem Tourism Cultural Community Learning Projects: This trip will include two teams working on two projects, which will continue throughout the Spring semester with potential credits being earned in: Generative AI: Our stakeholder has requested a student team to help consolidate, summarize, and compile automated stakeholders reports on the operations of the non-profit (i.e. vaccination campaigns for stray dogs in multiple countries, etc.). Visual Computing: Our stakeholder has also indicated an interested in using visual computing via camera traps, which would provide an overall count of (unique and differentiated) stray dogs within strategic areas near Chiang Mai. This would require image-based machine learning to identify unique characteristics of the dogs to avoid duplicate counts. Note: (1) The transportation fees and expenses regarding activities occurring in the camp will be fully covered by the program. (2) Your seat is not guaranteed in submitting the registration form due to the capacity and amenities of the plan

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skills and Assessments None specified.

2.4.10 Details for Competency HAS-133

HAS-133: AI and Computer Engineering for Community Impact III

Identity code: ALCOMMUNITY_3.4

Required? No

Credits: 4 (Graded)

Description

This competency offers students a unique opportunity to apply their knowledge of AI and computer engineering in real-world community settings. Throughout the time, students will engage in hands-on projects and community service activities designed to address specific needs within local communities. The course emphasizes experiential learning, fostering practical skills, social responsibility, and a deeper understanding of the societal impacts of technology. Term: Spring (during Winter Break) Location: Varied (local community sites) Format: On-site, activities-based, no lecture

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skills and Assessments None specified.

2.4.11 Details for Competency HAS-143

HAS-143: AI and Computer Engineering for Community Impact IIII

Identity code: ALCOMMUNITY_4.4

Required? No

Credits: 4 (Graded)

Description

This competency offers students a unique opportunity to apply their knowledge of AI and computer engineering in real-world community settings. Throughout the time, students will engage in hands-on projects and community service activities designed to address specific needs within local communities. The course emphasizes experiential learning, fostering practical skills, social responsibility, and a deeper understanding of the societal impacts of technology. Term: Spring (during Winter Break) Location: Varied (local community sites) Format: On-site, activities-based, no lecture

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skills and Assessments None specified.

2.4.12 Details for Competency HAS-108

HAS-108: Behavioral Economics

Identity code: BEHAV_ECONOMICS_9

Required? No

Credits: 8 (Graded)

Description

No description provided

Responsible Instructor: Buraskorn Torut

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HAS-108:00010	Principles of Economics	Quiz or exam	Assessment:Principles of Economics: Take a quiz that evaluates key concepts on these topics	Understand	<i>None</i>	<i>None</i>
HAS-108:00020	Principles of Economics	Hands-on problem	Assessment:Principles of Economics: Application based activities	Analyze	<i>None</i>	<i>None</i>
HAS-108:00030	Principles of Economics	Quiz or exam	Assessment:Principles of Economics: Take a quiz that evaluates key concepts on these topics	Understand	<i>None</i>	<i>None</i>
HAS-108:00040	Principles of Economics	Hands-on problem	Assessment:Principles of Economics: Application based activities	Analyze	<i>None</i>	<i>None</i>
HAS-108:00050	Principles of Economics	Quiz or exam	Assessment:Principles of Economics: Take a quiz that evaluates key concepts on these topics	Understand	<i>None</i>	<i>None</i>
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.4.13 Details for Competency HAS-106

HAS-106: History of Visual Arts

Identity code: ART_HISTORY_8

Required? No

Credits: 8 (Graded)

Description

Have you ever felt that you liked an artwork but couldn't explain why? Do you have questions about art that you were always afraid to ask? This course is conceived to give students the tools to feel at home when visiting a museum and talk about art in social, business and academic settings. It is organized over two semesters, but students can take only one of the two courses. Cultural History of the Visual Arts covers the period from the 1500s to the 2000s and features masterpieces and lesser known works in Western and Non-Western art, organized chronologically and by theme. Some of the topics we will study include the controversy surrounding Leonardo's and Michelangelo's works, the role of censorship in the arts, the development of perspective experiments and visual theories from Antiquity onward, the concept of landscape and the status of the artist in the Ming dynasty, the impact of colonialism and post-colonial identity in South American Art, the rediscovery of Pompeii and Herculaneum and the Egyptian craze in the 1800s, the world of Opera and ballet, and the Impressionists' ideas of what an artwork should be. Some of the topics we will study include the invention of a modern ways of seeing in Japanese art; the impact of science, film and photography on the Impressionists; the myth of the artist as a savage, a fool, and a prophet; the creation of ideal homes for common (and uncommon) people; the meaning of the avant-garde; and the many ways in which artists and politicians experiment with art and architecture in order to control our minds and emotions. The course also includes museum visits that will be organized taking in consideration the students' schedule. No prerequisite required and open to students from all disciplines.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HAS-106:00010	Visual Arts from the 1500s to the 1700s: Renaissance and Baroque	Imported assessment	Analyzing major works by Leonardo, Michelangelo, and their controversies: Perspective Analysis: Students will select a Renaissance painting and write an essay analyzing its use of perspective, citing the development of visual theories from Antiquity onward (assessing visual theory comprehension and analytical skills).	Analyze	<i>None</i>	<i>None</i>
HAS-106:00020	Art and Colonialism: 18th and 19th Century Western and Non-Western	Imported assessment	Understanding how the rediscovery of ancient civilizations influenced European art and culture: Comparative Landscape Essay: Students will compare Western and Non-Western depictions of landscapes, analyzing differences in technique, symbolism, and cultural significance (assessing ability to compare and evaluate art across cultures).	Analyze	<i>None</i>	<i>None</i>
HAS-106:00030	Visual Arts in the 19th and 20th Centuries: Modernism and Beyond	Observational assessment	Understanding the influence of science, film, and photography on Impressionist art: Impressionist Art Critique: Students will visit a museum or analyze an online collection featuring Impressionist works, writing a critique that explains how science, film, and photography influenced the visual techniques used (assessing analytical skills and art criticism).	Analyze	<i>None</i>	<i>None</i>
HAS-106:00040	Contemporary Visual Arts: Politics, Emotion, and Identity	Imported assessment	Understanding how political forces use art and architecture to influence society: Political Art Analysis: Students will select a contemporary work of art or architectural piece associated with a political regime and write an analysis on how the work is used to control emotions or influence public perception (assessing ability to interpret art in political contexts).	Analyze	<i>None</i>	<i>None</i>

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.4.14 Details for Competency HAS-107

HAS-107: History of music

Identity code: MUSIC_HISTORY_8

Required? No

Credits: 8 (Graded)

Description

This course provides a comprehensive exploration of the history of music from ancient times to the contemporary era. Students will engage with foundational music historical theories and methodologies to analyze and compare significant musical movements, styles, and works across different cultures and periods. Topics include the study of musicological methodologies, key movements from the Baroque period to Contemporary Music, musical forms and structures, and non-Western music traditions. Through critical evaluation and comparative analysis, students will gain a deeper understanding of how music has evolved and interacted globally. This course fosters critical thinking and auditory literacy, preparing students to appreciate and engage with music in diverse cultural contexts.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skills and Assessments None specified.

2.5 HCD Pillar

2.5.1 Details for Competency HCD-103

HCD-103: Creating Explainable AI

Identity code: EXPLAINABLE_AI_4

Required? No

Credits: 4 (Graded)

Description

One of the primary challenges in the field of AI is the concept of "black-boxes", or a clear understanding of why an AI produces a particular outcome from a user perspective. Creating explainable AIs is a way to formulate a user experience for interactive machine learning programs (iML) which emphasizes usability from a human-centered perspective.

Responsible Instructor: Orathai Sangpetch

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-103:00010	Model explainability	Quiz or exam	Assessment: Model explainability: Write a concise, original two-page essay that discusses the meaning of "explainability" in the context of AI and explains why it is important. Include specific examples (or counter-examples) with citations.	Analyze	2	2
HCD-103:00020	Explainability in model development	Hands-on problem	Assessment: Explainability in model development: Build an AI system that can explain its decisions or outputs	Create	1	1
HCD-103:00030	Explainability in model development	Hands-on problem	Assessment: Explainability in model development: Identify strengths and weaknesses in AI UI design choices within specific AI-based environments	Understand	2, 3	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.2 Details for Competency HCD-502

HCD-502: Interaction Design & Experience Design

Identity code: INTERACT_DESIGN_10

Required? No

Credits: 10 (Graded)

Description

Designing for user interaction (UI) and optimizing the user experience (UX) is a central pillar in user-centered design thinking, as it pertains to how users will engage with digital content and what that engagement will feel like experientially. This course will identify best practices within both UX and UI, and demonstrate case studies and examples to emphasize how these best practices are used in real-world applications.

Responsible Instructor: UNSPECIFIED

Prerequisites

- HCD-501 - Accessibility & Universal Design

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-502:00010	Fundamental Understanding of the Experiential Design Process	Quiz or exam	Assessment: Fundamental Understanding of the Experiential Design Process: Demonstrate a complete understanding of the role of UX within the design process.	Understand	2, 4, 6	2, 4
HCD-502:00020	Fundamental Understanding of the Experiential Design Process	Hands-on problem	Assessment: Fundamental Understanding of the Experiential Design Process: Apply interactive elements to an existing technology and/or user experience	Apply	1, 2	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.3 Details for Competency HCD-503

HCD-503: User Research: Methodologies, Data, and Design Thinking

Identity code: USER_RESEARCH_4

Required? No

Credits: 4 (Graded)

Description

Digital product and services are predicated on filling needs and solving problems for modern customers, and this problem-solving begins with understanding the users themselves. User research methodologies are leveraged to collect targeted data on customer touchpoints (and pain points), and that data is translated into optimized design thinking in the form of products, services, and solutions to customer problems. This course provides tools and process to conduct effective user research, and to apply this process within real-life scenarios.

Responsible Instructor: UNSPECIFIED

Prerequisites

- MAT-205 - Probability Distributions
- MAT-206 - Statistical Inference

Distribution Areas

- Core Technical
- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-503:00010	Fundamental Understanding of the Experiential Design Process	Hands-on problem	Assessment: Fundamental Understanding of the Experiential Design Process: Apply research outcomes to a design document for a digital product/service.	Apply	2, 6	1, 2
HCD-503:00020	Fundamental Understanding of the Experiential Design Process	Quiz or exam	Assessment: Fundamental Understanding of the Experiential Design Process: Understand the different data-oriented research methods, and in what circumstances to use them.	Understand	6	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.4 Details for Competency HCD-101

HCD-101: Visualization

Identity code: VISUALIZATION_4

Required? Yes

Credits: 4 (Graded)

Description

Explore the relationship between visual perception and digital presentation of content, with a particular focus on computer systems. This includes visualization techniques to improve the presentation of websites, complex data sets, digital media, and virtual worlds.

Responsible Instructor: Pisut Wisessing

Prerequisites

- SEN-101 - Algorithmic Thinking & Problem Solving
- SEN-102 - Introduction to Programming

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-101:00010	Principles of Human Visual Perception	Imported assessment	Assessment: Summarize the critical characteristics of human vision that affect visualization: Pick three characteristics of visual perception, then explain how they impact the effectiveness of visualization using computer systems. This can be done orally or in writing.	Understand	2	2
HCD-101:00020	Storytelling with Data Visualization	Imported assessment	Assessment: Identify the important dimensions in a visualization: Given an example of a computer system or web site that depends on visualization, identify the most important dimensions used and critique the effectiveness.	Analyze	2	2
HCD-101:00030	Practical Guidelines for Visualization	Imported assessment	Assessment: Critique effective and ineffective visualizations: Find three examples of web sites that you think provide effective visualization, and three that are not effective. For each example, describe the factors and decisions by the designer that make the visualization effective or not effective. Refer to the practical guidelines and best practices for telling a story with visualization.	Evaluate	2	2
HCD-101:00040	Visualization Tools and Resources	Imported assessment	Implement visualization techniques to a data set or website: complete four lab exercises	Apply	<i>None</i>	<i>None</i>
HCD-101:00050	Visualization Tools and Resources	Imported assessment	Design a visualization for a data set, website or API: Given a specific data set including some explanation of its contents, design one or more visualizations that effectively communicate the content and relationships in the data. In other words, create at least one of the three visualization designs using D3 for visualizing (1) numerical data, (2) spatial data, and (3) textual data.	Create	2	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.5 Details for Competency HCD-104

HCD-104: Immersive Environment (AR/VR/MR/XR)

Identity code: IMMERSIVE_ENV.6

Required? No

Credits: 6 (Graded)

Description

Immersive environments are simulations in which computer-generated imagery and other stimuli are combined with the experience of the real world, to engage the senses of users through real-time 3D graphics, audio, and interaction.

Depending on the amount of real/physical versus simulated/generated material, the results can be labeled as Virtual Reality (VR), Augmented Reality (AR), or Mixed Reality (MR). There is also Extended Reality (XR) that is a collective/umbrella term for various forms of immersive environments. This is a competency in both the theory and practice of immersive environments that are used in a variety of settings, including training, education, healthcare, entertainment, online collaboration and scientific visualization. You will have the opportunity to learn about the basics and key concepts of immersive environments and how to get started creating content and designing interfaces and developing interactions, followed by deployment on headsets and mobile devices.

Responsible Instructor: Hossein Miri

Prerequisites

- SEN-101 - Algorithmic Thinking & Problem Solving
- SEN-102 - Introduction to Programming

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-104:00010	History, Context, Technology, Applications	Imported assessment	Assessment: Know what constitutes an immersive environment and why they have been created throughout history: Write an essay (max 3000 words) that summarizes your understanding of what immersive environments are and why they were created, i.e., what constitutes an immersive environment and why they have been created throughout history.	Understand	<i>None</i>	<i>None</i>
HCD-104:00020	History, Context, Technology, Applications	Imported assessment	Assessment: Identify what their application areas are and how they are used today in terms of technology and implementation: Write an essay (max 3000 words) that highlights some of the most common application areas of immersive environments as well as which one you believe is the most worthwhile with the greatest societal impact, including your logic and reasoning for your choice. In other words, identify the most common application areas of immersive environments and state (with your logic and reasoning) which one you believe is the worthiest of all with the highest social impact.	Analyze	<i>None</i>	<i>None</i>
HCD-104:00030	Presence, Immersion, Depth Perception, 3D Vision	Imported assessment	Assessment: Understand presence and immersion and know the difference between the two: Write an essay (max 1000 words) that outlines your understanding of the key concepts of presence and immersion, i.e., what presence and immersion are, and what the difference between the two is.	Evaluate	<i>None</i>	<i>None</i>
HCD-104:00040	Presence, Immersion, Depth Perception, 3D Vision	Imported assessment	Assessment: Remember what cues enable depth perception and how that leads to immersion: Write an essay (max 2000 words) that lays out your understanding of the key concepts of depth perception leading to the experience of immersion, as well as the source of depth information, i.e., visual, oculomotor, monocular, binocular, etc.	Evaluate	<i>None</i>	<i>None</i>
HCD-104:00050	Interfaces, Actions, Interactions, Input/output	Imported assessment	Assessment: Create an interactive immersive environment in a game engine (e.g., Unity) containing game objects, 3D models, and an animated character that uses physics and AI path-finding (e.g., Unity NavMeshAgent) to move towards a destination point specified by the user's mouse click.: Create an interactive immersive environment in a game engine (e.g., Unity) including game objects, lights, textures, animations, basic physics interactions (jumping, collision, etc) that has at least one 3D model imported from Blender as .fbx file as well as a character imported from Mixamo and then via scripting and NavMeshAgent, get your character to move towards a destination point when you click somewhere in the scene. You will be quizzed on how you set up the project and how you wrote the NavMeshAgent script.	Create	<i>None</i>	<i>None</i>
HCD-104:00060	Content Creation and Game development with Unity	Imported assessment	Assessment: Using Unity to create immersive environments and games: Using Unity to create immersive environments and games	Apply	<i>None</i>	<i>None</i>

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.6 Details for Competency HCD-401

HCD-401: Game Development

Identity code: GAME_DEV_6

Required? No

Credits: 6 (Graded)

Description

Game Development will bring you on a journey across the full development cycle of a Game, from Inception to Live-Ops. With a Design-centric approach, we will break down the Production pipeline that is the current standard in both Industrial HD (AAA) and functional Studio-sized game development organizations.

With a Design-centric approach, this course will equip you with the means to create and structure the production of a Game Design Project. Practice will focus on applying and adapting Production methodologies to current Student's projects.

It is advised to complement this course with the courses "Game Engine Fundamentals", and "Engineered Arts".

Responsible Instructor: Lorenzo Avi

Prerequisites

None

Distribution Areas

- Core Technical
- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-401:00010	Game Development Cycle	Hands-on problem	Understand and apply game development methodologies: Understand and apply game development methodologies	Analyze	2, 3, 7	2, 3
HCD-401:00020	Game Development Cycle	Hands-on problem	Adapt and analyze Player Profiles: Adapt and analyze Player Profiles	Analyze	2, 3	2, 3
HCD-401:00030	Game Development Roles and Responsibilities	Hands-on problem	Understand and analyze a Development Team structure: Understand and analyze a Development Team structure	Analyze	3, 5, 7	2, 3
HCD-401:00040	Game Development Roles and Responsibilities	Hands-on problem	Understand and create development progress tracking: Understand and create development progress tracking	Apply	2, 3	2, 3
HCD-401:00050	Production Methodologies	Hands-on problem	Understand and create production Gates: Understand and create production Gates	Create	2, 3, 5, 7	2, 3
HCD-401:00060	Production Methodologies	Hands-on problem	Understand and Create the scoping of a game's content: Understand and Create the scoping of a game's content	Create	2, 3	2, 3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.7 Details for Competency HCD-402

HCD-402: Game Design

Identity code: GAME_DESIGN_6

Required? No

Credits: 6 (Graded)

Description

Game Design will equip you with the fundamental game design notions necessary to articulate a Game’s overall design or an Interactive Experience.

With a creative mindset and a pragmatic approach, you will experiment with the content of this Design toolbox for your own Game Project. You will design Gameplay Loops, 3Cs, Interactions, NPC Archetypes, and other components. Practice will focus on communicating your designs simply, visually, and efficiently to various audiences and collaborating disciplines.

It is advised to complement this course with the courses ””Game Engine Fundamentals”, and ””Engineered Arts”.

Responsible Instructor: Lorenzo Avi

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences
- Soft Skills

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-402:00010	Creative Game Vision	Hands-on problem	Understand and create a Game Vision proposal: Understand and create a Game Vision proposal	Create	2, 3, 7	3
HCD-402:00020	Creative Game Vision	Hands-on problem	Understand and Analyze Player Profiles: Understand and Analyze Player Profiles	Create	2, 3, 7	2, 3
HCD-402:00030	Feature Design	Hands-on problem	Understand and create the design of a game feature: Understand and create the design of a game feature.	Create	2, 3	3
HCD-402:00040	Feature Design	Hands-on problem	Understand and create core gameplay loops: Understand and create core gameplay loops	Create	2, 3	2, 3
HCD-402:00050	Game Progression Design	Hands-on problem	Understand and criticize a Game Pitch: Understand and criticize a Game Pitch	Evaluate	3	3
HCD-402:00060	Game Progression Design	Hands-on problem	Understand and create the design of a creative direction: Understand and create the design of a creative direction	Create	2, 3	2, 3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.8 Details for Competency HCD-403

HCD-403: Narrative Design

Identity code: NARRATIVE_DESIGN_6

Required? No

Credits: 6 (Graded)

Description

Digital storytelling, in both gaming and interactive digital media more broadly, requires a thorough understanding of the architecture of a narrative. Narrative allows players, users, and customers to project themselves into an experience, and this is achieved through a carefully designed user experience (UX). This course will cover narrative conception/ideation, storyboarding, narrative design modeling, production tracking, dialogue writing, variable-driven user choices (i.e. interactive design), and user testing.

Responsible Instructor: Justin Paulsen

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-403:00010	Narrative Conception	Hands-on problem	Assessment: Narrative Conception: Begin ideating a narrative-based project in digital media (gaming or film)	Remember	3	3
HCD-403:00020	Narrative Conception	Hands-on problem	Assessment: Narrative Conception: Produce a thematically-consistent narrative design	Apply	6, 7	2
HCD-403:00030	Narrative Pipeline Integration	Hands-on problem	Assessment: Narrative Pipeline Integration: Demonstrate a knowledge of ludonarrative alignment through a brief presented example	Apply	2, 5	2
HCD-403:00040	Narrative Pipeline Integration	Hands-on problem	Assessment: Narrative Pipeline Integration: Outline the narrative design for the final project, and translate that narrative design into actionable storybeats	Create	1, 2	2
HCD-403:00050	Narrative Prototyping & Dialogue Writing	Hands-on problem	Assessment: Narrative Prototyping & Dialogue Writing: Write a playable scene(s) using Twine or Articy	Create	1, 2	1, 2
HCD-403:00060	Narrative Prototyping & Dialogue Writing	Hands-on problem	Assessment: Narrative Prototyping & Dialogue Writing: Publish this scene via .html and present a choice-driven experience to the class	Create	2, 3	1, 2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.9 Details for Competency HCD-404

HCD-404: Game Engine and Project Prototyping

Identity code: GAME_PROTO_6

Required? No

Credits: 6 (Graded)

Description

Application of Game Engine & Project Prototyping is a hands-on course designed to deepen your understanding of game design and development through the iterative process of prototyping. This course explores the theory and practice of rapid game prototyping, including professional methodologies. You will learn why prototyping is essential in game development, how to align prototypes with core game systems, and how to effectively manage design choices to achieve cohesive gameplay experiences. With a strong focus on practical execution, this lab-based course challenges you to push the boundaries of design, technology, and artistic direction by advancing one of your current game or experience prototypes. Along the way, you will refine your ability to test ideas, evaluate systems, and balance creativity with technical feasibility.

Responsible Instructor: Lorenzo Avi

Prerequisites

None

Distribution Areas

- Core Technical
- Math/Science
- Humanities and Social Sciences
- R&D
- Soft Skills

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-404:00010	Game Prototyping	Hands-on problem	Create effective Design documentation.: Create all the applicable design documentation required to execute the prototype.	Create	1, 2, 7	2, 3
HCD-404:00020	Game Prototyping	Hands-on problem	Create and Implement components for the Prototype: Understand and create key components, and integrate these into the Prototype.	Create	1, 2, 3, 5, 7	2, 3, 5
HCD-404:00030	Game Prototyping	Hands-on problem	Apply development methodologies through the development process of the prototype.: Apply development methodologies through the development process of the prototype.	Apply	3, 4, 5, 7	2, 3, 4, 5
HCD-404:00040	Game Prototyping	Hands-on problem	Design and Create a Game Prototype: Create, Design, and Implement in group a Game Prototype	Create	1, 2, 3, 5, 6, 7	2, 3, 5

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.10 Details for Competency HCD-405

HCD-405: Sound Design

Identity code: SOUND_DESIGN_4

Required? No

Credits: 4 (Graded)

Description

Students will identify, generate, and compose all four of the key audio inputs for a digital media product/game. These include:

MX: Music within gaming operates within unique constraints, including in-game triggers and composing original soundtracks which can play continuously and shift cleanly based on player behavior. **SFX:** Generate all of the required active sounds within a gaming environment (i.e. item collection notification, weapon impacts, etc.). **BG/Foley:** Apply atmospheric and player-centric ambience, such as footfalls and other environmental context. **VX:** Learn the basics of voice acting and locution, as well as how to record and edit dialogue audio based on characterization.

This course will predominantly be a lab, with a few lectures and (hopefully) a guest speaker or two. It will be student-driven, and students should explore and select a digital audio workstation (DAW) to work within during the course. Ableton, ProTools, FLStudio, and Reaper are the recommended options (I'll be running Ableton).

Responsible Instructor: Justin Paulsen

Prerequisites

None

Distribution Areas

- Core Technical
- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-405:00010	Sound Design	Quiz or exam	Assessment: Sound Design: Foundations: Identify different types of sounds, and understand how they are applied and triggered within a virtual environment.	Understand	2	2
HCD-405:00020	Sound Design	Hands-on problem	Create and compose SFX to be used in real digital media projects: Use digital audio workstations, microphones, and/or AI to produce compelling and original soundscapes (SFX and BG/FOLEY).	Create	1, 2	2
HCD-405:00030	Sound Design	Hands-on problem	Compose an OST : Use a DAW of your choice, and balance a variety of VSTs (or physically recorded instruments, if you preferable). Layer at least half a dozen instruments across 3-5 segments with a unifying motif.	Create	1, 2	2
HCD-405:00040	Sound Design	Hands-on problem	Act, record, and edit voiceover for a digital media project: Learn how to create voiceover materials for various mediums.	Create	2	2
HCD-405:00050	Sound Design	Observational assessment	Apply sound design to an existing media product: Students will review strong and weak examples of sound design in various digital media formats, and then select one to mute the audio out of. They will then rework the entire audio in their DAW of choice, and apply that audio to the clip.	Evaluate	2, 3	2, 3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.11 Details for Competency HCD-406

HCD-406: Virtual Production

Identity code: VIRTUAL_PRODUCTION_6

Required? No

Credits: 6 (Graded)

Description

There are a variety of roles within the broader field of virtual production, including directing, writing, cinematography, content editing, and technology integration. Students will learn how to manage this wide variety of talent and resources, create feasible project timelines, identify key technological integrations, and manage the budgetary constraints of production. Virtual production aligns technical skills, project management, and creative direction to produce compelling digital content.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Core Technical
- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-406:00010	Virtual Production: Foundations	Quiz or exam	Assessment: Virtual Production: Foundations: Demonstrate a thorough understanding of the production process, including talent and resources.	Understand	3, 5	3, 5
HCD-406:00020	Virtual Production: Foundations	Hands-on problem	Assessment: Virtual Production: Foundations: Apply project management to existing student projects to demonstrate virtual production mastery.	Apply	1, 5	2, 5

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.12 Details for Competency HCD-407

HCD-407: Visual Storytelling

Identity code: VISUAL_STORY_6

Required? No

Credits: 6 (Graded)

Description

Capturing organic and authentic motion, in both 2D and 3D formats, requires a combination of technical tools and creative vision to bring a virtual scene to life. This course focuses on the key creative competencies alongside the modern technical tools necessary to implement your ideas.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-407:00010	Visual & Motion Design: Foundations	Quiz or exam	Assessment: Visual & Motion Design: Foundations: Demonstrate an understanding of motion design within a real-life context.	Understand	1	2
HCD-407:00020	Visual & Motion Design: Foundations	Hands-on problem	Use motion design tools: Apply motion design tools to a small project which demonstrates realistic motion.	Apply	1, 2	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.13 Details for Competency HCD-408

HCD-408: Introduction to Spatial Gaming

Identity code: SPATIAL_GAMING_4

Required? No

Credits: 4 (Graded)

Description

Virtual reality and augmented reality both pose demanding requirements of game developers, as the full virtual world must be realized seamlessly in 360 degrees. This includes user interactivity and user experience for navigating within this world, including the incorporation of new controller types, motion sensors, and object mapping. This course emphasizes the unique challenges and corresponding solutions presented by such an environment, while pushing the boundaries of what is possible through creative and innovative ideation for this emerging market segment.

Responsible Instructor: UNSPECIFIED

Prerequisites

- HCD-104 - Immersive Environment (AR/VR/MR/XR)

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-408:00010	Apply basic functionality to a gamified VR/AR environment	Quiz or exam	Assessment: Apply basic functionality to a gamified VR/AR environment: Understand how VR/AR will impact design documentation and game development planning	Understand	1, 2	2
HCD-408:00020	Apply basic functionality to a gamified VR/AR environment	Hands-on problem	Assessment: Apply basic functionality to a gamified VR/AR environment: Apply a theoretical understanding of VR/AR constraints to a prototype or gameplay demo.	Apply	1, 2	2
HCD-408:00030	Understand the constraints of VR/AR game design	Interview/oral exam	Assessment: Understand the constraints of VR/AR game design: Evaluate VR/AR game design choices in action, and use feedback to iterate towards optimal design choices.	Evaluate	1, 3, 4	2, 3, 4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.14 Details for Competency HCD-501

HCD-501: Accessibility & Universal Design

Identity code: ACCESSIBILITY_2

Required? Yes

Credits: 2 (Graded)

Description

Understanding the broad diversity of users within a digital media offering, and customizing the UX/UI design to accommodate this variance within the user base, is a critical component of modern design thinking. This course will apply principles and best practices to create user interfaces that are usable by individuals who have disabilities including perceptual, cognitive or motor deficits.

Responsible Instructor: Justin Paulsen

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-501:00010	Basics of Design & Accessibility	Hands-on problem	Explain what accessibility means and why it is important: This assessment will document the following: 1. What is presently inaccessible about the concept or project; 2. How a thorough universal design analysis identifies gaps in accessibility; and, 3. Possible methods of interventions to iterate towards broader product usage.	Understand	2	2
HCD-501:00020	Fundamentals of Universal Design (UD)	Hands-on problem	Apply accessibility principles and guidelines in real systems: This means taking the outcome of the first assignment, and beginning a full-scale universal design overhaul. Focus on integrating assistive technology, alongside deliberate design decisions which elegantly circumvent potential or existing gaps in universal accessibility. As a small piece of advice - clever design is often as effective (or more effective) than complex technological integrations and tangible assistive technologies. Great designers employ creativity towards elegance in accessible design. The optimal deliverable here is a prioritized list of interventions, alongside resource requirements, timelines, and justifications for each one. Demonstrate through examples what good design would look like in the suggested overhauled version.	Apply	2	2
HCD-501:00030	UD and Real-World Applications	Hands-on problem	Demonstrate the Value Proposition of Universal Design: The ideal demonstration of mastery includes: A quantitative and qualitative assessment of the opportunity cost of NOT designing with the broadest possible accessibility; A clear and intuitive description of gaps, alongside actionable design iterations to resolve them; and, A defensible business case incorporating the ethical burden, financial cost, and legal risks of inaccessible design choices. You will have a maximum of ten minutes to make your case. These three assessments combined will represent an overall group grade for this project and course.	Apply	2, 3	2, 3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.15 Details for Competency HCD-504

HCD-504: Psychology for User Interface Design

Identity code: PSYCH_FOR_UL4

Required? No

Credits: 4 (Graded)

Description

Usability is one of the most important success criteria for mobile applications, websites, hardware devices and other digital products. Highly usable products allow users to accomplish their goals efficiently, effectively and comfortably. In contrast, products with poor usability lead to mistakes, extra effort, lost time and frustration.

Various aspects of human psychology strongly influence the usability of products. This competency will introduce students to important characteristics of human perception, cognition, language and emotion that must be considered in order to design an effective, attractive and comfortable user interface. Through hands-on demonstrations and experiments, students will learn how to apply psychological principles in evaluating and building product interfaces.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Core Technical
- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-504:00010	User Interface Design	Hands-on problem	Create a UI design that considers psychological principles: Given a written specification for a web site to perform a particular type of task, create a wireframe or interactive prototype that considers constraints due to attention, memory and language.	Create	2, 3	2, 3
HCD-504:00020	User Interface Evaluation	Hands-on problem	Recognize poor design choices in existing UIs: Identify a website that you consider to have very poor usability due to violating various psychological principles. Write a paper with screen shots analyzing the usability problems.	Analyze	3	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.16 Details for Competency HCD-201

HCD-201: Ethics in computer engineering

Identity code: ETHICS_CE.2

Required? Yes

Credits: 2 (Graded)

Description

Computer engineering and AI offer incredible capabilities to both individuals and institutions, but with great capabilities come great responsibilities. This competency focuses on ethical concerns as they relate to the decisions of engineers, not the decisions of AI systems. HCD-201 covers a wide range of topics including privacy, safety, integrity, bias and diversity, and intellectual property. We use the ACM Code of Ethics and Professional Conduct as our framework, analyzing case studies and engineering projects in order to identify ethical issues and conflicts and to suggest strategies for resolving these issues. **NOTE:** Because the activities in this competency are group-based and interactive, attendance in class sessions is **REQUIRED** in order to receive credit.

Responsible Instructor: Sally Goldin

Prerequisites

None

Distribution Areas

- Core Technical
- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-201:00010	Ethical principles for computing professionals	Hands-on problem	Assessment: Apply the ACM code of professional ethics to real-world scenarios: Given a case study or description of a proposed engineering project, analyze the content, alternatives and possible outcomes based on the principles in the ACM code	Analyze	3	3, 4
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.5.17 Details for Competency HCD-202

HCD-202: Ethical Principles for AI (Fairness, Accountability, Transparency, Ethics)

Identity code: ETHICAL_AI.4

Required? No

Credits: 4 (Graded)

Description

Use the FATE model of ethical AI principles to assess AI applications as they pertain to real-world products and services. This includes:

Fairness: AI design should maintain an objective and unbiased perspective in both input data and output behaviors.

Accountability: AI must consistently demonstrate complete responsibility, alongside methods to enforce this through auditing.

Transparency: How AI generates decision and/or behaviors must be clear and demonstrable to any and all involved parties.

Ethics: AI must respect human dignity, privacy, and autonomy at all stages of development and usage.

Responsible Instructor: Sally Goldin

Prerequisites

- HCD-201 - Ethics in computer engineering

Distribution Areas

- Core Technical
- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-202:00010	Bias in AI systems	Imported assessment	Assessment: Recognizing and preventing bias in AI systems: Given a description of an AI project, identify possible sources and types of bias and recommend ways to reduce or eliminate it.	Analyze	None	None
HCD-202:00020	Transparency in AI systems	Imported assessment	Assessment: Recognizing and promoting transparency: Given a description of an AI project, identify and explain areas where it may be lacking in transparency, and recommend ways to improve it.	Analyze	None	None
HCD-202:00030	Accountability for AI systems	Imported assessment	Assessment: Analyzing issues related to accountability: Find three articles from the popular press where accountability for AI system behavior is an issue. For each one, provide your recommendation about who should be responsible or accountable for damage done.	Analyze	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.18 Details for Competency HCD-301

HCD-301: Game Engine Fundamentals

Identity code: GAME_ENGINE_8

Required? No

Credits: 8 (Graded)

Description

This competency will equip you with the fundamental technical knowledge required to build a Gameplay prototype: Environments, Player Navigations, Interactions, 3Cs,...

You will apply your learnings to a personal game prototype, using the Unreal 5 game engine and its core functionalities. It is advised to complement this course with the courses "Game Design", and "Engineered Arts".

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-301:00010	Unreal 5 Game Engine	Observational assessment	Apply learnings of Unreal 5 Technology: Instructor will assess Student's competency based on required technical exercises.	Apply	1	1
HCD-301:00020	Unreal 5 Game Engine	Hands-on problem	Create original Content with Unreal 5 Technology: An assignment to demonstrate the ability to solve related sophisticated problems.	Create	2	2
HCD-301:00030	In-game Navigation and Interactions	Observational assessment	Apply learnings of 3Cs and Interactions in Unreal 5: Instructor will assess Student's competency based on required technical exercises.	Apply	1	1
HCD-301:00040	In-game Navigation and Interactions	Hands-on problem	Create original 3Cs and Interaction in Unreal 5: An assignment to demonstrate the ability to solve related sophisticated problems.	Create	2	2
HCD-301:00050	Gameplay Prototyping	Observational assessment	Apply learnings of Prototyping in Unreal 5: Instructor will assess Student's competency based on required technical exercises.	Apply	1	1
HCD-301:00060	Gameplay Prototyping	Hands-on problem	Create original Gameplay Prototype with Unreal 5: An assignment to demonstrate the ability to solve related sophisticated problems.	Create	2	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.19 Details for Competency HCD-302

HCD-302: Engineered Arts

Identity code: ENG_ARTS_6

Required? No

Credits: 6 (Graded)

Description

Engineered Arts is a hands-on exploration of digital creativity and technical artistry, designed to bridge the gap between conceptual design and interactive development. This course is structured in two focused modules: 3D Modeling and Asset Creation using Blender, and Dynamic Visual Effects and Interactivity powered by Unreal Engine. Students will delve into essential skills such as sculpting and modeling, UV mapping, and texturing, before advancing to crafting realistic shaders, materials, lighting setups, and immersive VFX using Unreal Engine's Niagara system.

Throughout the course, you will bring your ideas to life in a personal project, learning how to combine artistic expression with technical precision.

It is advised to complement this course with the courses "Game Engine Tech", and "Game Design".

Responsible Instructor: Thanut Panichyotai

Prerequisites

- HCD-301 - Game Engine Fundamentals

Distribution Areas

- Core Technical
- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-302:00010	3D Modelling and Texturing	Observational assessment	Apply learnings of 3D Modeling: Instructor will assess Student's competency based on required technical exercises.	Apply	1	1
HCD-302:00020	3D Modelling and Texturing	Hands-on problem	Create original 3D assets and Environments: An assignment to demonstrate the ability to solve related sophisticated problems.	Create	2	2
HCD-302:00030	Artistic Execution	Observational assessment	Apply learnings of Design and Art theory: Instructor will assess student's competency based on required technical exercises.	Apply	1	1
HCD-302:00040	Artistic Execution	Hands-on problem	Create original and consistent Interactive Environments: An assignment to demonstrate the ability to solve related sophisticated problems.	Create	2	2
HCD-302:00050	Tech and Art Synergy	Observational assessment	Apply Creative and Technical learnings: Instructor will assess student's competency based on required technical exercises.	Apply	1	1
HCD-302:00060	Tech and Art Synergy	Hands-on problem	Create consistent Creative and Technical combinations: An assignment to demonstrate the ability to solve related sophisticated problems.	Create	2	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.20 Details for Competency HCD-303

HCD-303: Engineered Arts: AI for Gaming

Identity code: ENG_ARTS_AI_GAME_6

Required? No

Credits: 6 (Graded)

Description

Game development can incorporate AI from various perspectives: AI tools are increasingly refined from procedural content generation, asset creation, NPC behaviors, or interactive simulations to become key components of modern game development practices. This course will explore the most popular tools integrated, or not, with Unreal 5.

Responsible Instructor: UNSPECIFIED

Prerequisites

- HCD-301 - Game Engine Fundamentals
- HCD-302 - Engineered Arts
- HCD-402 - Game Design
- AIC-101 - Introduction to Artificial Intelligence

Distribution Areas

- Core Technical
- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-303:00010	AI in Arts	Observational assessment	Understand and Apply Generative AI Art Tools: Take a quiz that evaluates key distinctions and concepts on these topics.	Apply	1	1
HCD-303:00020	AI in Arts	Hands-on problem	Create new Artistic AI Content: An assignment to demonstrate the ability to solve related sophisticated problems.	Create	2	2
HCD-303:00030	AI in Videogames	Observational assessment	Understand and criticize Design of AI Agents in Game contexts: Take a quiz that evaluates key distinctions and concepts on these topics.	Apply	1	1
HCD-303:00040	AI in Videogames	Hands-on problem	Create AI Agents to solve a challenge: An assignment to demonstrate the ability to solve related sophisticated problems.	Create	2	2
HCD-303:00050	AI for Engineering	Observational assessment	Understand and Apply AI to solve Engineering challenges: Take a quiz that evaluates key distinctions and concepts on these topics.	Apply	1	1
HCD-303:00060	AI for Engineering	Hands-on problem	Create an original AI-Engineered solution: An assignment to demonstrate the ability to solve related sophisticated problems.	Create	2	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.5.21 Details for Competency HCD-304

HCD-304: Character Animation and Motion Capture

Identity code: CHAR_ANIMATION_4

Required? No

Credits: 4 (Graded)

Description

This competency is designed for AI and Computer Engineering students to explore the technical dimensions of character animation and motion capture. Focusing on hands-on learning, students will gain practical experience with motion capture systems, data processing, and AI applications in animation. The course covers the implementation of pose estimation algorithms, data cleanup techniques, and the integration of motion capture data into animation pipelines, preparing students for advanced work in animation technology and AI-driven tools.

Responsible Instructor: Pisut Wisessing

Prerequisites

None

Distribution Areas

- Core Technical
- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
HCD-304:00010	Character Animation in Creative Industry	Interview/oral exam	Explain the role of character animation: Students will create a video essay explaining character animation's role in a creative pipeline, using examples from industry projects.	Understand	None	None
HCD-304:00020	Principles of Animation	Hands-on problem	Understand the 12 Principles of Animation: Students will complete hands-on lab exercises that involve replicating small animations showcasing specific principles.	Understand	None	None
HCD-304:00030	Digital Character Creation	Hands-on problem	Design and Develop Basic Character Models: Students will participate in hands-on lab assignments where they design and rig basic character models.	Apply	None	None
HCD-304:00040	Motion Capture	Hands-on problem	Create Animation Using Motion Data: Students will complete a motion capture project where they capture movement, process the data, and use it to create a unique character animation sequence.	Create	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.6 MAT Pillar

2.6.1 Details for Competency MAT-201

MAT-201: Matrices and Linear Transformations (Linear algebra)

Identity code: LINEAR_ALG_12

Required? Yes

Credits: 12 (Graded)

Description

No description provided

Responsible Instructor: Pitikhate Sooraksa

Prerequisites

None

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
MAT-201:00010	Vectors and Matrices	Imported assessment	Assessment: Calculating basic operations for vectors and matrices: Solve basic vector and matrix equations including additions/subtraction, dot product, matrices multiplication (by block), transpose, etc.	Apply	None	None
MAT-201:00020	Linear transformation	Imported assessment	Assessment: Determining basic matrices of linear transformations: Given a basic linear transformation (e.g., rotation), design a matrix equivalent to the transformation and vice versa	Understand	None	None
MAT-201:00030	Matrix Factorization	Imported assessment	Assessment: Applying matrix decomposition to solve linear equations: Given a 2x2 matrix A, find a limit to A to the n-th power as n approaches infinity	Apply	None	None
MAT-201:00040	Eigenvectors and eigenvalues	Imported assessment	Assessment: Calculating eigenvalues and eigenvectors: Given a 2x2 and 3x3 matrices, find their eigenvalues and eigenvectors	Apply	None	None
MAT-201:00050	Rank and nullity of matrices and linear transformation	Imported assessment	Assessment: Determining the rank and nullity of a matrix and linear transformation: Given a matrix or linear transformation, determine its rank	Apply	None	None
MAT-201:00060	Solving Linear Equations	Imported assessment	Assessment: Solving linear equations: Given a set of linear equations, write them in matrix form. Determine if the solution is unique. If yes, calculate the unique solution.	Analyze	None	None
MAT-201:00070	Least square minimisation	Imported assessment	Assessment: Solving least square minimisation method: Derive the solution to least square minimisation	Understand	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.6.2 Details for Competency MAT-202

MAT-202: Signal Processing and Data Domains

Identity code: DATA_DOMAINS_4

Required? No

Credits: 4 (Graded)

Description

No description provided

Responsible Instructor: UNSPECIFIED

Prerequisites

- MAT-102 - Calculus - Basic derivatives
- MAT-101 - Calculus - Differentiation
- MAT-103 - Calculus - Integration

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
MAT-202:00010	Data Domains — Time/Frequency Domain	Imported assessment	Assessment: The concept of Data Domains: Analyst the concept of Data Domains	Analyze	<i>None</i>	<i>None</i>
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.6.3 Details for Competency MAT-203

MAT-203: Descriptive Statistics

Identity code: DESC_STATS_2

Required? Yes

Credits: 2 (Graded)

Description

No description provided

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
MAT-203:00010	Descriptive Statistics	Hands-on problem	Compute and interpret descriptive statistics of a sample: Given a sample of observations compute its descriptive statistics and interpret them.	Analyze	<i>None</i>	1
MAT-203:00020	Descriptive Statistics	Imported assessment	Visualize variables from a data set: Given data set, present relevant variables in the most appropriate way. Taking into consideration data quality and preprocessing. Interpreting the charts.	Analyze	<i>None</i>	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.6.4 Details for Competency MAT-204

MAT-204: Introduction to Probability

Identity code: PROD_DATA_3

Required? Yes

Credits: 3 (Graded)

Description

No description provided

Responsible Instructor: UNSPECIFIED

Prerequisites

- MAT-203 - Descriptive Statistics

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
MAT-204:00010	Probability Theory	Quiz or exam	Determine the probability space: Given a random phenomenon determine an appropriate probability space to model it, and use it to calculate the probability of some events of interest.	Understand	<i>None</i>	1
MAT-204:00020	Conditional Probability	Quiz or exam	Use of Bayes' theorem: Given data from a random phenomenon, use Bayes' theorem to calculate the probability of some events of interest.	Apply	<i>None</i>	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.6.5 Details for Competency MAT-205

MAT-205: Probability Distributions

Identity code: PROB_DIST_3

Required? Yes

Credits: 3 (Graded)

Description

No description provided

Responsible Instructor: UNSPECIFIED

Prerequisites

- MAT-204 - Introduction to Probability

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
MAT-205:00010	Discrete Random Variables	Quiz or exam	Determine the appropriate random variable: Given a random phenomenon, determine an appropriate random variable to model it, and use it to calculate the probability of some events of interest.	Understand	<i>None</i>	1
MAT-205:00020	Continuous Random Variables	Quiz or exam	Use of the De Moivre - Laplace limit theorem: Compute the exact probability of events of interest using a Binomial distribution and approximate them with an appropriate Normal distribution.	Understand	<i>None</i>	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.6.6 Details for Competency MAT-206

MAT-206: Statistical Inference

Identity code: INFER_STATS_3

Required? Yes

Credits: 4 (Graded)

Description

No description provided

Responsible Instructor: UNSPECIFIED

Prerequisites

- MAT-205 - Probability Distributions

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
MAT-206:00010	Estimation	Hands-on problem	Punctual, interval and regional estimation: Given a sample from a Normal distribution compute: punctual estimators for its mean and variance; maximum likelihood of the parameters, and confidence intervals and regions for a specified significance level. Also compute a prediction interval for a future observation.	Understand	<i>None</i>	1
MAT-206:00020	Hypothesis Test	Hands-on problem	Hypothesis testing for mean, variance, and ANOVA: Given data from different populations, if the appropriate assumptions are satisfied, perform hypothesis tests on the mean, and variance. Also perform an ANOVA to determine if the means can be considered equal.	Apply	<i>None</i>	<i>None</i>
MAT-206:00030	Linear Regression	Hands-on problem	Adjust and analyze a linear regression model: Given a variable of interest and covariates, perform and analyze a linear regression. Including the analysis of the assumptions and the creation of appropriate plots and figures.	Analyze	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.6.7 Details for Competency MAT-207

MAT-207: Discrete Mathematics

Identity code: DISCRETE_MATH_12

Required? Yes

Credits: 12 (Graded)

Description

No description provided

Responsible Instructor: Jidapa Thadajarassiri

Prerequisites

None

Distribution Areas

- Core Technical
- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
MAT-207:00010	Sets	Quiz or exam	Understand the basic sets of numbers and their operations: Understand the basic sets of numbers, be able to calculate the union, intersection, difference of sets, and cartesian products, and determine whether or not two sets are equal using the double inclusion method	Apply	<i>None</i>	<i>None</i>
MAT-207:00020	Sets	Quiz or exam	Be able to determine the number of elements of a set using elementary rules such as product rule, sum rule, and inclusion/exclusion. Understand the basic logical operations and the difference between an implication and a double implication.: Be able to determine the number of elements of a set using elementary rules such as product rule, sum rule, and inclusion/exclusion.	Apply	<i>None</i>	<i>None</i>
MAT-207:00030	Number theory	Quiz or exam	Understand the concept of basic number theory concepts and theorem such as prime numbers, and modular arithmetic: Understand the concept of basic number theory concepts and theorem such as prime numbers, and modular arithmetic	Apply	<i>None</i>	<i>None</i>
MAT-207:00040	Counting techniques	Quiz or exam	Be able to apply basic counting principles and understand binary numbers as well as other number systems : Be able to apply basic counting principles and understand binary numbers as well as other number systems	Apply	<i>None</i>	<i>None</i>

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.6.8 Details for Competency MAT-101

MAT-101: Calculus - Differentiation

Identity code: CALC_DIFFERENTIATION_3

Required? No

Credits: 3 (Graded)

Description

No description provided

Responsible Instructor: Puttha Sakkaplangkul

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
MAT-101:00010	Differentiation	Imported assessment	Assessment: The concept of limits and derivatives: - Take a quiz that can show and solve the problems in the definition of limits and derivatives - Problem solving in class	Understand	<i>None</i>	<i>None</i>
MAT-101:00030	Differentiation	Imported assessment	Assessment: limits and derivatives problem solving: Take a quiz that can show and solve the problems in the definition of limits and derivatives Problem-solving in class	Apply	<i>None</i>	<i>None</i>

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.6.9 Details for Competency MAT-102

MAT-102: Calculus - Basic derivatives

Identity code: CALC_DERIVATIVES_2

Required? No

Credits: 2 (Graded)

Description

No description provided

Responsible Instructor: Puttha Sakkaplangkul

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
MAT-102:00010	Basic derivatives	Imported assessment	Assessment: the concept of basic functions: Take a quiz that can show and solve the problems in the of the basic functions Problem solving in class	Understand	None	None
MAT-102:00020	Basic derivatives	Imported assessment	Assessment: Basic functions derivatives: - Take a quiz that can show and solve the problems in the of the basic functions - Problem solving in class	Apply	None	None
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.6.10 Details for Competency MAT-103

MAT-103: Calculus - Integration

Identity code: CALC_INTEGRATION_4

Required? No

Credits: 4 (Graded)

Description

No description provided

Responsible Instructor: Puttha Sakkaplangkul

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
MAT-103:00010	Integration	Imported assessment	Assessment: The concept of antiderivatives and integrations: Take a quiz that can show and solve the problems in the antiderivatives and integrations Problem solving in class	Understand	<i>None</i>	<i>None</i>
MAT-103:00020	Integration	Imported assessment	Assessment: Antiderivatives and integrations problem solving: - Take a quiz that can show and solve the problems in the antiderivatives and integrations - Problem solving in class	Apply	<i>None</i>	<i>None</i>

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.6.11 Details for Competency MAT-104

MAT-104: Calculus - Optimization

Identity code: CALC_OPTIMIZATION_3

Required? No

Credits: 3 (Graded)

Description

No description provided

Responsible Instructor: Puttha Sakkaplangkul

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
MAT-104:00010	Optimization	Imported assessment	Assessment: The concept of optimization methods: Take a quiz that can show and solve the problems in the optimization methods Problem solving in class	Understand	None	None
MAT-104:00020	Optimization	Imported assessment	Assessment: Optimizations to its applications problem solving: - Take a quiz that can show and solve the problems in the optimization methods - Problem solving in class	Apply	None	None
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.6.12 Details for Competency MAT-105

MAT-105: Vector Calculus

Identity code: VECTOR_CALC_6

Required? No

Credits: 6 (Graded)

Description

No description provided

Responsible Instructor: Jetjaroen Klangwang

Prerequisites

- MAT-101 - Calculus - Differentiation
- MAT-102 - Calculus - Basic derivatives
- MAT-103 - Calculus - Integration

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
MAT-105:00010	Vector Algebra	Hands-on problem	Basic Vector Algebra: Perform basic operations such as addition, subtraction, and scalar multiplication. Interpret the geometric meaning of these operations. Calculate dot and cross products of vectors and explain their geometric and physical significance. Use these concepts to solve practical problems.	Understand	1	1
MAT-105:00020	Scalar and Vector Functions	Hands-on problem	Gradient, Divergence, and Curl: Calculate the gradient of scalar fields, and the divergence and curl of vector fields. Explain their physical interpretations, such as rates of change, field outflows, and rotational behaviors, and apply them to simple problems in physics and engineering.	Apply	1	1
MAT-105:00030	Line and Surface Integrals	Hands-on problem	Line and Surface Integrals: Set up and calculate line integrals of scalar and vector fields and surface integrals of vector fields. Apply these concepts to compute work done by a force field along a path or flux through a surface.	Understand	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.6.13 Details for Competency MAT-106

MAT-106: Analytical Geometry

Identity code: ANALY_GEOM_6

Required? No

Credits: 6 (Graded)

Description

No description provided

Responsible Instructor: Jetjaroen Klangwang

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
MAT-106:00010	2D Geometry and Line Equations	Hands-on problem	Mastery of 2D Geometric Concepts, Line Equations, and Circle Equations: Student understanding will be assessed through weekly homework assignments that include problems on applying geometric formulas, deriving line and circle equations, and solving for distances, midpoints, slopes, and working with line relationships.	Apply	1	1
MAT-106:00020	Conic Sections and Their Properties	Hands-on problem	Understanding and Analyzing Conic Sections: Weekly homework will assess students' ability to derive and graph equations of conic sections, and to analyze their properties.	Apply	None	None
MAT-106:00030	Polar Coordinates and Graphing Curves	Hands-on problem	Conversion and Graphing in Polar Coordinates: Homework will assess students' ability to convert between coordinate systems and graph polar curves. Problems will require students to apply polar coordinate principles to graph and analyze curves, including conic sections, and to understand the geometric properties of those graphs.	Apply	None	None
MAT-106:00040	3D Geometry and Quadric Surfaces	Hands-on problem	Mastery of 3D Geometry and Quadric Surfaces: Students will be assessed through weekly homework assignments that involve calculating distances, midpoints, and equations in 3D space, as well as classifying and analyzing quadric surfaces and their intersections with planes.	Apply	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.6.14 Details for Competency MAT-107

MAT-107: Differential Equations and Approximation

Identity code: DIFF_EQUATIONS_12

Required? No

Credits: 12 (Graded)

Description

Differential equations are ubiquitous in physics, ecology, epidemiology, social sciences, among other sciences, since they can model the evolution of systems over time. We will discuss how to write mathematical models for different phenomena and how to solve such equations.

Differential equations are equations that involve the derivative of a function. To solve them, i.e. to determine the unknown function, we need to manipulate derivatives and compute integrals.

Throughout this competency we will learn how to model different phenomena through differential equations and finding the function that explains such phenomena. However, the solution of some differential equations does not admit a closed expression, but it can be expressed as an infinite series. We will discuss convergence of these series.

When it becomes too complicated to solve analytically the solution of the differential equation, we need to approximate the solution through a numerical method such as the Euler's method, the semi-implicit method, or Runge-Kutta. We will approximate the solution of intricate differential equations and systems of differential equations using numerical methods.

Responsible Instructor: Irving Gomez Mendez

Prerequisites

- MAT-101 - Calculus - Differentiation
- MAT-102 - Calculus - Basic derivatives
- MAT-103 - Calculus - Integration

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
MAT-107:00010	Qualitative analysis of first-order ODE	Quiz or exam	Analyze first-order ODE: Given a first-order ODE, sketch the family of solutions on the computer using directional fields, analyze its qualitative characteristics, and solve it.	Apply	1	1
MAT-107:00020	Linear first-order ODE	Quiz or exam	Solve linear and nonlinear first-order ODE: Solve a given linear and non-linear first-order ODE.	Apply	1	None
MAT-107:00030	Non-linear first-order ODE	Quiz or exam	Solve high-order linear ODE with constant coefficients: Given a high-order linear with constant coefficients ODE: Identify its fundamental set of solutions, find the solution to the homogeneous equation, and the particular solution.	Analyze	1	None
MAT-107:00040	Cauchy-Euler's equations	Quiz or exam	Solve high-order ODE without constant coefficients: Solve a given a Cauchy-Euler ODE, or a high-order linear ODE without constant coefficients.	Apply	1	None
MAT-107:00050	Numerical methods for ODE	Quiz or exam	Implement numerical methods to solve differential equations: Implement numerical methods to solve differential equations such as Euler's, semi-implicit Euler's, Runge-Kutta.	Apply	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.7 SCI Pillar

2.7.1 Details for Competency SCI-101

SCI-101: Fundamentals of Biology

Identity code: BIOLOGY_12

Required? No

Credits: 12 (Graded)

Description

The Fundamentals of Biology course provides an introduction to the essential principles and concepts of biology. This course covers a wide range of topics, from the molecular and cellular basis of life to the interactions of organisms within ecosystems. Students will explore key biological processes, genetic principles, evolutionary theory, and ecological relationships. The course is designed to develop a solid foundation in biology, preparing students for advanced study in the biological sciences.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SCI-101:00010	Cell structure and function	Quiz or exam	Understanding of Cell Biology: Short-answer exams evaluating knowledge and application of cell biology concepts.	Understand	None	None
SCI-101:00020	Mendelian genetics and inheritance patterns	Quiz or exam	Understand Knowledge of Genetics and Heredity: Short-answer exams testing knowledge of genetic principles and heredity mechanisms.	Understand	None	None
SCI-101:00030	Natural selection and adaptation	Imported assessment	Understand Comprehension of Evolutionary Biology: Essays that require students to explain evolutionary concepts and evidence supporting the theory of evolution.	Understand	None	None
SCI-101:00040	Ecosystems and biodiversity	Imported assessment	Understanding of Ecology and Environmental Biology: Essays analyzing ecological interactions and environmental issues.	Analyze	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.7.2 Details for Competency SCI-102

SCI-102: Fundamentals of Chemistry

Identity code: CHEMISTRY_12

Required? No

Credits: 12 (Graded)

Description

The Fundamentals of Chemistry course provides an introduction to the essential principles and concepts of chemistry. This course covers a wide range of topics, from the atomic and molecular structure to chemical reactions and their applications. Students will explore key chemical principles, the behavior of gases, solutions, and thermodynamics. The course is designed to develop a solid foundation in chemistry, preparing students for advanced study in the chemical sciences.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SCI-102:00010	Electron configuration and periodic trends	Quiz or exam	Understanding of Atomic and Molecular Structure: Short-answer exams evaluating knowledge and application of atomic and molecular structure concepts.	Understand	None	None
SCI-102:00020	Balancing chemical equations and reaction types	Quiz or exam	Knowledge of Chemical Reactions and Stoichiometry: Short-answer exams testing knowledge of chemical reaction principles and stoichiometry.	Understand	None	None
SCI-102:00030	Ideal gas law and kinetic molecular theory	Imported assessment	Comprehension of States of Matter and Gas Laws: Essays that require students to explain states of matter and gas law concepts.	Understand	None	None
SCI-102:00040	Enthalpy, entropy, and Gibbs free energy	Imported assessment	Understanding of Thermodynamics and Chemical Equilibria: Essays analyzing thermodynamic concepts and chemical equilibria.	Understand	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.7.3 Details for Competency SCI-104

SCI-104: Quantum Physics

Identity code: QUANTUM.PHYSICS.12

Required? No

Credits: 12 (Graded)

Description

The Quantum Physics for Engineering Students course provides an introduction to the principles and concepts of quantum mechanics with a focus on applications relevant to engineering. This course covers fundamental topics such as wave-particle duality, quantum states, and the Schrödinger equation. Students will explore the implications of quantum mechanics for modern technology, including semiconductors, nanotechnology, and quantum computing. The course is designed to develop a solid foundation in quantum mechanics, preparing students for advanced study and professional practice in engineering fields that utilize quantum principles.

Responsible Instructor: Thiparat Chotibut

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SCI-104:00010	Mathematics for Quantum Science	Hands-on problem	Apply Linear Algebra and Probability Theory to study physical systems and real-world phenomena: Solve unknown problems and exercises that reflect the ability to apply and analyze relevant problems.	Analyze	1	1
SCI-104:00020	Basic Quantum Physics	Hands-on problem	Apply the rules and postulate of quantum physics to make predictions of quantum phenomena.: Solve problems related to basic quantum dynamics, and simulate the outcome of quantum measurement in simple quantum systems.	Analyze	1	1
SCI-104:00030	Applications of Quantum Physics	Hands-on problem	Apply quantum theory and simulate basic quantum chemistry.: Solve problems related to bonding energies and molecular configurations.	Apply	1	1
SCI-104:00040	Basic Quantum Information and Algorithms	Hands-on problem	Apply basic quantum gates to perform quantum computations, and simulate basic quantum algorithms using a classical computer.: Implement quantum gate operations in Qiskit (or PennyLane). Use quantum simulators to implement quantum circuits.	Evaluate	1, 2	1, 2
SCI-104:00050	Basic Programming Quantum Computers	Hands-on problem	Design quantum circuits using basic quantum gates. Design and implement a quantum algorithm project of choice.: Program and run basic quantum operations on a simulator. Complete a project showcasing a quantum algorithm.	Create	1, 2	1, 2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.7.4 Details for Competency SCI-105

SCI-105: Kinematics: describe motion (Physis I)

Identity code: KINEMATICS_3

Required? No

Credits: 3 (Graded)

Description

The Kinematics: Describing Motion course provides an introduction to the fundamental principles and concepts of kinematics, the branch of mechanics that deals with the motion of objects. This course covers topics such as displacement, velocity, acceleration, and the equations of motion.

Responsible Instructor: Chinnapat Rattanasirawit

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SCI-105:00010	Units, Physical Quantities, Vectors, Motion in One Dimension, Motion in 2 or 3 Dimensions	Imported assessment	Assessment: Evaluation of units, physical quantities and vectors: Take a quiz that evaluates key distinctions and concepts on these topics	Understand	None	None
SCI-105:00020	Units, Physical Quantities, Vectors, Motion in One Dimension, Motion in 2 or 3 Dimensions	Imported assessment	Assessment: Units, Physical Quantities and Vectors problem solving: An assignment to demonstrate the ability to solve related sophisticated problems	Analyze	None	None
SCI-105:00030	Units, Physical Quantities, Vectors, Motion in One Dimension, Motion in 2 or 3 Dimensions	Imported assessment	Assessment: The concept of motion in one dimension: Take a quiz that evaluates key distinctions and concepts on these topics	Understand	None	None
SCI-105:00040	Units, Physical Quantities, Vectors, Motion in One Dimension, Motion in 2 or 3 Dimensions	Imported assessment	Assessment: The Motion problem solving: An assignment to demonstrate the ability to solve related sophisticated problems.	Apply	None	None
SCI-105:00050	Units, Physical Quantities, Vectors, Motion in One Dimension, Motion in 2 or 3 Dimensions	Imported assessment	Assessment: The circular motion and the motion in 2 or 3 dimensions.: Take a quiz that evaluates key distinctions and concepts on these topics	Understand	None	None
SCI-105:00060	Units, Physical Quantities, Vectors, Motion in One Dimension, Motion in 2 or 3 Dimensions	Imported assessment	Assessment: Motion kinematically problem solving: An assignment to demonstrate the ability to solve related sophisticated problems.	Apply	None	None
SCI-105:00070	Units, Physical Quantities, Vectors, Motion in One Dimension, Motion in 2 or 3 Dimensions	Imported assessment	Assessment: Analyses projectile motion kinematically: **Project assignment to demonstrate ability to setup the experiment and to analyze the projectile motion from experimental data.	Apply	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.7.5 Details for Competency SCI-106

SCI-106: Dynamics: explain motion (Physics I)

Identity code: DYNAMICS.3

Required? No

Credits: 3 (Graded)

Description

This competency provides an introduction to the fundamental principles and concepts of kinematics, the branch of mechanics that deals with the motion of objects. This course covers topics such as displacement, velocity, acceleration, and the equations of motion.

Responsible Instructor: Chinnapat Rattanasirawit

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SCI-106:00010	Newton's Laws of Motion, Applications of Newton's Laws, Circular Motion, Gravity	Imported assessment	Assessment: The Newton's Laws problems solving: Given an assignment of sophisticated problems to solve	Analyze	None	None
SCI-106:00020	Newton's Laws of Motion, Applications of Newton's Laws, Circular Motion, Gravity	Imported assessment	Assessment: The concept of Newton's Laws of motion: -Take a quiz that evaluates key distinctions and concepts on these topics	Understand	None	None
SCI-106:00030	Newton's Laws of Motion, Applications of Newton's Laws, Circular Motion, Gravity	Imported assessment	Assessment: The Applications of Newton's Laws problem solving: An assignment to demonstrate the ability to solve related sophisticated problems	Apply	None	None
SCI-106:00040	Newton's Laws of Motion, Applications of Newton's Laws, Circular Motion, Gravity	Imported assessment	Assessment: Circular Motion problem solving: An assignment to demonstrate the ability to solve related sophisticated problems	Apply	None	None
SCI-106:00050	Newton's Laws of Motion, Applications of Newton's Laws, Circular Motion, Gravity	Imported assessment	Assessment: Applying the Newton's Law of Gravitation to solve physics problems: An assignment to demonstrate the ability to solve related sophisticated problems	Apply	None	None
SCI-106:00060	Newton's Laws of Motion, Applications of Newton's Laws, Circular Motion, Gravity	Imported assessment	Assessment: The Applications of Newton's Laws: Take a quiz that evaluates key distinctions and concepts on these topics	Apply	None	None
SCI-106:00070	Newton's Laws of Motion, Applications of Newton's Laws, Circular Motion, Gravity	Imported assessment	Assessment: The involvement of Newton's Law of Gravitation found in real-life: Take a quiz that evaluates key distinctions and concepts on these topics	Apply	None	None
SCI-106:00080	Newton's Laws of Motion, Applications of Newton's Laws, Circular Motion, Gravity	Imported assessment	Assessment: The concept of Circular Motion: Take a quiz that evaluates key distinctions and concepts on these topics	Apply	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.7.6 Details for Competency SCI-107

SCI-107: Energy and Momentum (Physics I)

Identity code: ENERGY_MOM.3

Required? No

Credits: 3 (Graded)

Description

It provides an introduction to the fundamental principles and concepts of energy and momentum in the context of classical mechanics. This course covers topics such as work, kinetic and potential energy, the conservation of energy, linear momentum, and the conservation of momentum.

Responsible Instructor: Prathan Buranasiri

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SCI-107:00010	Work & Kinetic Energy, Power & Potential Energy, Energy & Momentum	Imported assessment	Assessment: The concept of power, gravitational potential energy and elastic potential energy: Take a quiz that evaluates key distinctions and concepts on these topics	Apply	None	None
SCI-107:00020	Work & Kinetic Energy, Power & Potential Energy, Energy & Momentum	Imported assessment	Assessment: The concept of momentum, collisions, impulse and the conservation of momentum: Take a quiz that evaluates key distinctions and concepts on these topics	Understand	None	None
SCI-107:00030	Work & Kinetic Energy, Power & Potential Energy, Energy & Momentum	Imported assessment	Assessment: the concept of work and kinetic energy and how they relate to the force: Take a quiz that evaluates key distinctions and concepts on these topics	Apply	None	None
SCI-107:00040	Work & Kinetic Energy, Power & Potential Energy, Energy & Momentum	Imported assessment	Assessment: Work and kinetic energy problem solving: An assignment to demonstrate the ability to solve related sophisticated problems.	Understand	None	None
SCI-107:00050	Work & Kinetic Energy, Power & Potential Energy, Energy & Momentum	Imported assessment	Assessment: Power, gravitational potential energy and elastic potential energy problem solving: An assignment to demonstrate the ability to solve related sophisticated problems.	Understand	None	None
SCI-107:00060	Work & Kinetic Energy, Power & Potential Energy, Energy & Momentum	Imported assessment	Assessment: Momentum, collisions, impulse and the conservation of momentum problem solving: An assignment to demonstrate the ability to solve related sophisticated problems	Apply	None	None
SCI-107:00070	Work & Kinetic Energy, Power & Potential Energy, Energy & Momentum	Imported assessment	Assessment: The conservation force, non conservation force, and conservation of energy: Take a quiz that evaluates key distinctions and concepts on these topics	Understand	None	None
SCI-107:00080	Work & Kinetic Energy, Power & Potential Energy, Energy & Momentum	Imported assessment	Assessment: Conservation force, non conservation force, and conservation of energy problem solving: An assignment to demonstrate the ability to solve related sophisticated problems	Apply	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.7.7 Details for Competency SCI-108

SCI-108: Thermodynamics (Physics I)

Identity code: THERMODYN_3

Required? No

Credits: 3 (Graded)

Description

Thermodynamics is the study of energy and its transformations. This foundational course explores the principles governing heat, work, and energy transfer within engineering systems. Students will delve into the laws of thermodynamics, including concepts such as entropy, temperature, and the relationships between different forms of energy

Responsible Instructor: Lunchakorn Tannukij

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SCI-108:00010	Thermal Properties of Matter, 1st Law and 2nd of Thermodynamics, Entropy, Introduction to Information Theory	Imported assessment	Assessment: Understand components involved in the 1st law of thermodynamics: Take a quiz that evaluates key distinctions and concepts on these topics	Understand	None	None
SCI-108:00020	Thermal Properties of Matter, 1st Law and 2nd of Thermodynamics, Entropy, Introduction to Information Theory	Imported assessment	Assessment: Apply the concepts of ideal gas to simplified gas systems in nature: An assignment to demonstrate the ability to solve related sophisticated problems	Apply	None	None
SCI-108:00030	Thermal Properties of Matter, 1st Law and 2nd of Thermodynamics, Entropy, Introduction to Information Theory	Imported assessment	Assessment: Understand the origin and consequences of 2nd law of thermodynamics: Take a quiz that evaluates key distinctions and concepts on these topics	Understand	None	None
SCI-108:00040	Thermal Properties of Matter, 1st Law and 2nd of Thermodynamics, Entropy, Introduction to Information Theory	Imported assessment	Assessment: Understand the involvement of the 1st law in thermal systems found in real-life: Take a quiz that evaluates key distinctions and concepts on these topics	Understand	None	None
SCI-108:00050	Thermal Properties of Matter, 1st Law and 2nd of Thermodynamics, Entropy, Introduction to Information Theory	Imported assessment	Assessment: Understand the concept of entropy: Take a quiz that evaluates key distinctions and concepts on these topics	Understand	None	None
SCI-108:00060	Thermal Properties of Matter, 1st Law and 2nd of Thermodynamics, Entropy, Introduction to Information Theory	Imported assessment	Assessment: Apply the basic usages of entropy in information theory: An assignment to demonstrate the ability to solve related sophisticated problems	Apply	None	None
SCI-108:00070	Thermal Properties of Matter, 1st Law and 2nd of Thermodynamics, Entropy, Introduction to Information Theory	Imported assessment	Assessment: The concept of phase changes (heat capacity, latent heat): Take a quiz that evaluates key distinctions and concepts on these topics	Understand	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.7.8 Details for Competency SCI-109

SCI-109: Electricity (Physics II)

Identity code: ELECTRICITY_4

Required? No

Credits: 4 (Graded)

Description

This course provides a comprehensive introduction to the principles and applications of electricity. Students will delve into fundamental concepts such as electric charge, electric fields, and electric potential. The course covers Ohm's law and explores series and parallel circuits, emphasizing their practical applications in engineering and everyday devices. Topics include magnetic fields, electromagnetic induction, and the basics of AC and DC circuits.

Responsible Instructor: Suwun Suwunnarat

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SCI-109:00010	Property of Electric Charges and its Motion	Hands-on problem	Apply the concept of forces to understand the interaction between the charges using Coulomb's law.: Given a set of problems on the electric charges, calculate the electric forces from a point charge and uniform electric fields. Given a set of problems on the nature of electric charges, predict their subsequent motion or their transfers.	Apply	1, 7	1
SCI-109:00020	Electric Field Lines and Electric Flux	Quiz or exam	Understand the nature of electric fields originating from a discrete charge distribution using superposition principle.: Given a set of problems on the electric field from many point charges, determine the force coming from a group of charge. Given a set of problems on the electric field lines and its graphical representation, determine its equivalence with electric fields.	Understand	1	1
SCI-109:00030	Electric Field Lines and Electric Flux	Hands-on problem	Apply the concept of electric field on a continuous charge distribution.: Given a set of problems on the electric field from continuous charge distribution, determine the force coming from it when the domain is a geometric shape with symmetry.	Apply	1, 7	1
SCI-109:00040	Electric Field Lines and Electric Flux	Hands-on problem	Apply the concept of electric flux through a flat surface.: Given a set of problems on a definition of electric flux, calculate its numerical value.	Apply	1, 7	1
SCI-109:00050	Gauss's Law and its Applications	Hands-on problem	Apply the concept of flux through a closed surface.: Given a set of problems on an application of Gauss's law, find the electric fields of a uniformly distributed charged domain	Apply	1, 7	1
SCI-109:00060	Electric Potential	Quiz or exam	Understand the connection between electric potential and electric field.: Given a set of problems on a definition of electric potential, find the electric field for a group of point charges including dipoles.	Understand	1	1
SCI-109:00070	Electric Potential	Hands-on problem	Apply the concept of electric potential to find the electric fields: Given a set of problems on the parallelism between the electric potential and electric potential energy, determine the electric field from the electric potential function for simple continuous geometry.	Apply	1, 7	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.7.9 Details for Competency SCI-110

SCI-110: Magnetism (Physics II)

Identity code: MAGNETISM_4

Required? No

Credits: 4 (Graded)

Description

This course delves into the fundamental principles and applications of magnetism, exploring its role in the natural world and technological applications. Students will start by studying the origins of magnetism, including magnetic fields and the behavior of magnetic materials. The course will cover topics such as the laws governing magnetic fields, electromagnetic induction, and the interaction of magnetic fields with electric currents.

Responsible Instructor: Lunchakorn Tannukij

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SCI-110:00010	Magnetic fields & magnetic force	Hands-on problem	Apply the concept of magnetic forces to charged particles and electric currents in a magnetic field.: Given a set of problems on the magnetic forces, calculate the magnetic forces exerted on a charged particle or an electric current using the Lorentz force law and connect the results with other generic physical ideas to predict possible trajectories or physical phenomena.	Apply	1	1
SCI-110:00020	Sources of magnetic fields	Hands-on problem	Understand the Biot-Savart law to find magnetic fields around magnetic sources and Apply the Ampère's law to find magnetic fields around magnetic sources.: -Given a set of problems on the source of the magnetic field, qualitatively explain how the magnetic field at a distance from a magnetic source can be realised. -Given a set of problems, realise the symmetry of the magnetic source and calculate the corresponding magnetic field from Ampère's law.	Understand	1	1
SCI-110:00030	Electromagnetic induction	Hands-on problem	Apply the Faraday's law and Lenz's law to find the electricity induced from a coil: Given a set of problems, determine the direction of the induced current using Lenz's law and calculate the potential difference induced in a coil and other electrical quantities.	Apply	1	1
SCI-110:00040	Electrodynamics & electromagnetic waves	Hands-on problem	Understand the physical meaning of the Maxwell's equations and Apply the concept of waves in the context of electromagnetic waves.: -Given the Maxwell's equations, connect the equations to the related concepts in electricity and in magnetism. -Given a set of problems, with a knowledge of the electromagnetic waves travelling at a speed of light, calculate the corresponding wavelength and frequency using the idea of travelling waves.	Apply	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.7.10 Details for Competency SCI-111

SCI-111: Light and Optics (Physics II)

Identity code: OPTICS.4

Required? No

Credits: 4 (Graded)

Description

This course explores the fundamental principles of light and optics, providing a comprehensive understanding of how light behaves and interacts with matter. Students will delve into topics such as geometrical optics, wave optics, polarization, diffraction, interference, and optical instruments. Through theoretical study and practical experiments, learners will investigate the properties of light, including reflection, refraction, dispersion, and the formation of images by lenses and mirrors.

Responsible Instructor: Suwun Suwunnarat

Prerequisites

None

Distribution Areas

- Math/Science

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SCI-111:00010	The nature of light, reflection and refraction of light waves	Hands-on problem	Apply the various approach to understand light as a distinct types of waves.: Given a set of problems starting from understanding the characteristic of light and its reflection and refraction properties, calculate the geometrical path of light, and generate the drawing representing Huygen's principles to prove the law of reflection.	Apply	1, 7	1
SCI-111:00020	Snell's law and image formation by mirrors	Quiz or exam	Understand the Snell's law to find the angle of refraction.: Given a set of problems on Snell's law, calculate various light propagation parameter and extreme circumstances such as total internal reflection, speed of light in matter, the angle of refraction, etc.	Understand	1	1
SCI-111:00030	Snell's law and image formation by mirrors	Hands-on problem	Apply both reflection and Snell's law to solve geometrical optics problems: Given a set of problems on Snell's law of light, accurately draw a pathway of light. Given a set of problems on mirrors, accurately determine the pathway of light and the image formed by it.	Apply	1, 7	1
SCI-111:00040	Image formation by lens and relateing optical instruments	Quiz or exam	Undersand refraction and the nature of image formed by lens.: Given a set of problems on lens and mirrors and its image formation, accurately draw the pathway of light and its image.	Understand	1	1
SCI-111:00050	Image formation by lens and relateing optical instruments	Hands-on problem	Apply the light manipulation techniques to come up with a distinct optical devices.: Given a set of problems on optical devices, such as microscope, telescope, or even simple eyeglasses, correctly pinpoint the advantageous reasons for such tools.	Apply	1, 7	1
SCI-111:00060	Diffraction and interference of light waves	Quiz or exam	Understand the light trajectories in diffraction and interference of light waves.: Given a set of problems on interferences, quantitatively determine the spreading of light from two point-sources. Given a set of problems on diffractions, use Huygen's principle to explain the spreading of light waves.	Understand	1	1
SCI-111:00070	Diffraction and interference of light waves	Hands-on problem	Apply the wave optics as a distict limit of light wave propagation to the phenomena of diffraction and interferences: Given a set of problems on graphical representation using Huygen's priciple, predict the pattern emerged from a more complicated setup.	Apply	1, 7	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.8 SEC Pillar

2.8.1 Details for Competency SEC-101

SEC-101: Data and Information Fundamentals

Identity code: DATA_AQUISITION_4

Required? Yes

Credits: 2 (Graded)

Description

Data is the most valuable asset in modern information systems. How engineers properly and securely acquire, prepare, transform, and cleanse data objects, based on their characteristics, is a mandatory skill. In this competency, you will learn about data representation and types, how we can acquire data in the required format, and how we can handle data outliers.

Responsible Instructor: Charnon Pattiyanon

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEC-101:00010	Data Acquisition, Preparation, Transformation and Cleaning	Imported assessment	Evaluate the relation of data acquisition, preparation, transformation and cleansing: Write an essay to describe the concept	Understand	1, 2, 3	2, 4
SEC-101:00020	Data Acquisition, Preparation, Transformation and Cleaning	Imported assessment	Assessment: Data Acquisition, Preparation, Transformation and Cleaning: Write an essay to demonstrate the analysis and design skills.	Analyze	1, 2, 3	2, 3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.8.2 Details for Competency SEC-102

SEC-102: Data Reduction and Compression

Identity code: DATA_COMPRESS_4

Required? No

Credits: 4 (Graded)

Description

The size of data is the key for efficient communications. You cannot send a video of 10GB to 10,000 users in the network at the same time. In this competency, you will learn how to reduce the amount of data to be properly and efficiently collected, transmitted, and processed, using various compression techniques.

Responsible Instructor: Akkarit Sangpetch

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEC-102:00010	Data Reduction and Compression	Hands-on problem	Assessment: Data Reduction and Compression: Complete a hands-on assignment of the technique implementation.	Apply	1, 2, 6	1, 2
SEC-102:00020	Data Reduction and Compression	Imported assessment	Assessment: Data Reduction and Compression: Write an essay to describe their relation in Data set	Understand	1, 6	2, 4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.8.3 Details for Competency SEC-103

SEC-103: Data Governance

Identity code: DATA-GOVERN_2

Required? No

Credits: 2 (Graded)

Description

How organizations gather, store, process, and dispose data is a serious concern for end-users. Data governance is a way to set an internal standard for an organization. In this competency, we will go through techniques to adopt principled data governance approaches to managing data object during its life cycle.

Responsible Instructor: Akkarit Sangpetch

Prerequisites

- HCD-201 - Ethics in computer engineering

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEC-103:00010	Data governance process, semantics rules and policies	Imported assessment	Assessment: Construct a data governance process according to the application's requirement: Engage with a third party in a data analytics task and construct the governance process that are acceptable to the third party while allowing the task to be completed.	Evaluate	None	None
SEC-103:00020	Data governance process, semantics rules and policies	Imported assessment	Assessment: Write semantics rules for data governance including information extraction, data integration and data cleaning: Implement a role-based access control or other semantics to control data access for a team or an organization	Create	None	None
SEC-103:00030	Data governance process, semantics rules and policies	Imported assessment	Assessment: Develop policies and processes to ensure the privacy and security of data: Develop policies and processes for a data collection project to ensure privacy & security of subjects providing data.	Create	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.8.4 Details for Competency SEC-201

SEC-201: Data Privacy, Security and Integrity

Identity code: DATA_PRIVACY_4

Required? Yes

Credits: 4 (Graded)

Description

Data is the most valuable asset in information systems. Most of the time, data contains personal information that could be harmful to its owner if exposed. In this competency, we will learn various techniques to preserve data privacy, security, and integrity properly and effectively.

Responsible Instructor: Charnon Pattiyanon

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEC-201:00010	Data and Information	Imported assessment	Analyze the sensitivity of data and information: An assignment to demonstrate an ability to classify personal data and analyze the personal data handling in existing systems against data properties.	Analyze	1, 6	2
SEC-201:00020	Data and Information	Hands-on problem	Analyze the secure data and information processing: An assignment to demonstrate an ability to create a information flow diagram and analyze from data security,	Create	1, 2, 3	2, 3
SEC-201:00030	Data Security	Quiz or exam	Evaluate data security in an information system: Take a quiz that evaluates an ability to analyze and create a data security module in a software application.	Evaluate	1, 2, 3, 6	2, 4
SEC-201:00040	Data Integrity	Quiz or exam	Evaluate data Integrity in an information system: Take a quiz that evaluates an ability to analyze and create a data integrity module in a software application.	Evaluate	1, 2, 3, 6	2, 3
SEC-201:00050	Data Privacy	Quiz or exam	Evaluate data privacy preservation mechanisms in an information system.: Take a quiz that evaluates an ability to analyze and design a data privacy preservation module in an information system.	Evaluate	1, 2, 3	2, 3
SEC-201:00060	Data Privacy	Hands-on problem	Analyze the compliance of data privacy laws and regulations.: An assignment to demonstrate an ability to analyze the compliance of a real-world system with data privacy laws and regulations.	Analyze	1, 2, 3, 6	2, 3, 4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.8.5 Details for Competency SEC-203

SEC-203: Securing System Infrastructure

Identity code: SEC-INFRASTRUCT.6

Required? No

Credits: 4 (Graded)

Description

System infrastructure plays a very important role in building an information system. System infrastructure is also another popular attack surface for adversaries. In this competency, we will learn and try various security techniques to secure system infrastructure against different kinds of attacks.

Responsible Instructor: Taweessup Apiwattanapong

Prerequisites

- SYS-205 - Storage and File Systems Fundamentals
- SYS-102 - Basic Computer Architecture

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEC-203:00010	Core Information Security Concepts	Hands-on problem	Understand fundamental information security (IS) concepts: "Pick an information security incident that happened in the real world. - Summarize the incidents: who is the threat actor, who is the victim, what attacks the threat actor perform, how much damage the incident costed. - Answer these questions: - Which characteristics are compromised: confidentiality, integrity and availability? Of which assets? - What vulnerabilities were exploited? - What could be done to prevent or stop the attacks? What could mitigate the damage? - Provide references to all source materials."	Analyze	3, 7	3
SEC-203:00020	Network Threats and Network Traffic Analysis	Hands-on problem	Understand network threats and analyze network traffic to detect threats: Given filtered and unfiltered network traffic logs, find packets that contain flags.	Analyze	1	None
SEC-203:00030	Firewalls	Hands-on problem	Design network zones and configure a firewall to restrict network access according to given requirements.: Given a network topology and network requirements, create a corresponding virtual network and configure a firewall to restrict network access according to the requirements	Create	1, 2	None
SEC-203:00040	Vulnerability Management	Hands-on problem	Perform some network attacks : Given a simulated network, perform open port analysis using 'nmap' and Man-in-the-middle attacks using a tool in Kali Linux	Apply	4, 6	None
SEC-203:00050	Vulnerability Management	Hands-on problem	Perform vulnerability assessment.: Given a simulated network and a host, perform vulnerability assessment using Nessus. Then, given changes in the characteristics of a vulnerability, compute the new CVSS score.	Evaluate	3, 7	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.8.6 Details for Competency SEC-204

SEC-204: Security Policy and Processes

Identity code: SEC_POLICY_4

Required? No

Credits: 4 (Graded)

Description

Security transcends its conventional perception as a mere safeguard for sensitive information within a system. Rather, it embodies a multifaceted paradigm necessitating the establishment of comprehensive organizational frameworks. These frameworks, comprising defined policies and processes, are pivotal in ensuring the continual preservation of data integrity and confidentiality at the highest echelons of security standards. Thus, beyond its technical underpinnings, security emerges as a holistic imperative, binding the responsibilities of administering and utilizing systems with the imperative to fortify the organizational fabric against potential threats and vulnerabilities. In this competency, we will explore the fundamental procedures for defining security policies and discuss the essential components they should encompass. Additionally, enforcing these policies requires organizational processes that blend both administrative and technical tasks to maintain adequate security levels. We will examine various security frameworks, such as ISO/IEC 27001 or the NIST Cybersecurity Framework (CSF). By the end of this competency, you should be proficient in analyzing security policies and implementing comprehensive security processes. The skills you acquire will prove invaluable when navigating the security landscape of real enterprises, where security is of paramount concern.

Responsible Instructor: Charnon Pattiyanon

Prerequisites

- SEC-201 - Data Privacy, Security and Integrity
- SEN-201 - Software Engineering Processes

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEC-204:00010	Security Policy and IT Governance	Quiz or exam	Assessment:Security Policy and IT Governance: Given an assignment of sophisticated problems to solve.	Analyze	3, 4, 7	3, 4
SEC-204:00020	Security Policy and IT Governance	Quiz or exam	Assessment:Security Policy and IT Governance: Given an assignment of sophisticated problems to solve.	Create	1, 2, 3, 4	2, 3, 4
SEC-204:00030	Security Processes and Frameworks	Quiz or exam	Assessment:Security Processes and Frameworks: Given an assignment of sophisticated problems to solve.	Analyze	1, 2, 3, 4	2, 3, 4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.8.7 Details for Competency SEC-205

SEC-205: Distributed ledger and Blockchain

Identity code: BLOCKCHAIN_4

Required? No

Credits: 4 (Graded)

Description

Bitcoin, blockchain technology, and smart contracts represent a trinity of transformative innovations that have reshaped the landscape of finance, technology, and beyond. At the heart of this paradigm shift lies Bitcoin, the pioneering cryptocurrency introduced by an anonymous entity known as Satoshi Nakamoto in a groundbreaking white paper published in 2008. Bitcoin, often hailed as digital gold, operates on a decentralized network facilitated by blockchain technology, a distributed ledger system that records transactions across a network of computers in a secure and transparent manner. Unlike traditional currencies, which are subject to centralized control by governments and financial institutions, Bitcoin enables peer-to-peer transactions without the need for intermediaries, thereby fostering financial autonomy and circumventing the limitations of traditional banking systems. Blockchain technology, the underlying innovation powering Bitcoin, represents a decentralized and immutable ledger system that has transcended its initial application in cryptocurrency to revolutionize various industries, ranging from supply chain management to healthcare and beyond. One of the most promising applications of blockchain technology is the concept of smart contracts, self-executing contracts with the terms of the agreement directly written into code. This competency offers a comprehensive exploration of distributed ledger and blockchain technology. Students will gain insight into the design and development of blockchain systems, delving into their inner workings. Additionally, hands-on lab sessions are incorporated into this competency, providing students with the opportunity to develop their own web 3.0 or decentralized applications (DApps).

Responsible Instructor: Charnon Pattiyanon

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEC-205:00010	Blockchain, Distributed Ledger, Bitcoin, and Smart Contracts	Quiz or exam	Assessment:Blockchain, Distributed Ledger, Bitcoin, and Smart Contracts: Given an assignment of sophisticated problems to solve.	Apply	1, 3, 7	1, 3
SEC-205:00020	Smart Contract Programming with Solidity	Hands-on problem	Assessment:Smart Contract Programming with Solidity: Given an assignment of sophisticated problems to develop a program for smart contract and write a development report.	Create	1, 2, 3, 6, 7	1, 2, 3
SEC-205:00030	Blockchain Privacy and Security, and Decentralized Identities	Quiz or exam	Assessment:Blockchain Privacy and Security, and Decentralized Identities: Given an assignment of sophisticated problems to solve.	Apply	2, 3, 4, 7	3, 4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.8.8 Details for Competency SEC-303

SEC-303: Vulnerability Assessment for Software Applications

Identity code: VULNERABILTY_ASSMT_4

Required? No

Credits: 4 (Graded)

Description

Security vulnerabilities impact various software applications and may be harmful to users' information. Consequently, these vulnerabilities must be properly identified, assessed, and mitigated. In this competency, we will delve into details on techniques to assess security vulnerabilities for software applications, both manually and automatically.

Responsible Instructor: Charnon Pattiyanon

Prerequisites

- SEC-201 - Data Privacy, Security and Integrity

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEC-303:00010	Vulnerability Assessment for Software Applications	Hands-on problem	Apply security vulnerability assessment techniques to real-world cases.: Write a report to demonstrate the steps applied to assess security vulnerabilities in a target system.	Apply	1, 6	2, 4
SEC-303:00020	Vulnerability Assessment for Software Applications	Hands-on problem	Apply security vulnerability assessment tools to software applications.: Write a report to summarize the adopted process of security vulnerability assessment with the tool and explain their understanding of the tool usage.	Apply	1, 6	2, 4
SEC-303:00030	Vulnerability Assessment for Software Applications	Quiz or exam	Understand the process of existing security vulnerability assessment: Write a report to exercise the analysis of existing security vulnerabilities from public vulnerability repositories.	Understand	1, 2, 6	2, 4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.8.9 Details for Competency SEC-401

SEC-401: Privacy Attacks

Identity code: PRIVACY_ATTACKS.2

Required? No

Credits: 2 (Graded)

Description

Privacy becomes a main target for exploiting personal data. Privacy attacks aim to make use of personal data to cause any harmful activities to its owner. In this competency, you will learn about various privacy attacks, including de-anonymization attacks, membership inference attacks, etc.

Responsible Instructor: Pasin Manurangsi

Prerequisites

- MAT-102 - Calculus - Basic derivatives
- MAT-201 - Matrices and Linear Transformations (Linear algebra)

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEC-401:00010	Attacks on Anonymized Data	Imported assessment	Understand the concepts and applications of de-anonymization attacks, reconstruction attacks and can apply the attacks in simple settings: Take a quiz on the topic, Assignment write a program to perform reconstruction attacks on a given aggregated data	Understand	1, 6	2
SEC-401:00020	Attacks on Machine Learning Models	Quiz or exam	Assessment: Understand the concepts of membership inference attacks, model inversion attacks, secret sharer: Take a quiz on the topic.	Understand	1, 6	2, 4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.8.10 Details for Competency SEC-402

SEC-402: Differential Privacy (DP)

Identity code: DIFF_PRIVACY_6

Required? No

Credits: 6 (Graded)

Description

Differential privacy is a privacy preservation technique that leverages the benefit of small changes to ensure minimal exposure of data characteristics. In this competency, you will explore various technical background behind the differential privacy technique. Also, the application beyond the mathematical foundation will be discussed in detail.

Responsible Instructor: Pasin Manurangsi

Prerequisites

- MAT-205 - Probability Distributions

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEC-402:00010	Concepts and definitions	Imported assessment	Understand the concepts of differential privacy and can determine if a given algorithm is differentially private, and understand the utility-privacy tradeoff for Laplace, Gaussian, exponential mechanisms and Randomized Response: Take a quiz on whether given algorithms are differentially private (and for what parameters) and can compute their utilities	Understand	1, 2	2, 3
SEC-402:00020	Properties of DP	Imported assessment	Assessment: Understand the concepts of post-processing, composition, group differential privacy and protection against privacy-related attacks: Take a quiz that evaluate the key concepts of conditional probability, and the Bayes theorem	Understand	2, 6	2
SEC-402:00030	Applications in ML	Hands-on problem	Assessment: Understand the DP-SGD algorithm, its privacy accounting and how to apply it to real datasets: Build differentially private machine classification models using the DP-SGD algorithms on simple datasets, demonstrate the effects on different parameters to its utility	Apply	1, 2, 6	1, 2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.8.11 Details for Competency SEC-301

SEC-301: Security Challenges in Modern AI Systems

Identity code: SEC_AI_SYSTEMS.2

Required? Yes

Credits: 2 (Graded)

Description

Currently, AI is a new hype in the community. We cannot deny that AI models and systems are produced and used in the consumer level effectively. However, security in AI systems are also paramount since they learn from data, sometimes personal data. In this competency, we will delve down into various security challenges in AI systems and techniques to investigate the security issues/attacks in AI systems.

Responsible Instructor: Charnon Pattiyanon

Prerequisites

- AIC-201 - Supervised Learning and Unsupervised Learning

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEC-301:00010	AI Security Risks	Quiz or exam	Analyze AI security Risks: Take a quiz that evaluates an ability to analyze AI security risks and apply standard AI security recommendation.	Analyze	1, 2	1, 2, 3
SEC-301:00020	AI Security Risks	Hands-on problem	Analyze AI security threats using analysis techniques: Write a report to demonstrate an ability to analyze a real-world AI system and model its security threats.	Analyze	1, 2, 3	2, 3
SEC-301:00030	Adversarial AI	Quiz or exam	Analyze AI-specific attack scenarios: Take a quiz that evaluates an ability to analyze and identify AI specific attacks and how to protect them.	Analyze	1, 6	2
SEC-301:00040	AI Safety	Hands-on problem	Understand AI Safety in academic: Write a report to demonstrate an ability to study a current research trend in AI Safety from existing works and identify research gaps.	Understand	1, 2, 3, 6	2, 3, 4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.8.12 Details for Competency SEC-302

SEC-302: Robustness of AI Components and Systems

Identity code: ROBUST_AI_SYSTEMS.6

Required? No

Credits: 4 (Graded)

Description

AI components and systems are considered robust if they can maintain its performance and stability under different conditions. In this competency, you will explore approaches and techniques to evaluate the robustness of AI components and systems. Also, you will have a chance to learn, apply, and evaluate techniques to ensure robustness in AI components and systems.

Responsible Instructor: Orathai Sangpetch

Prerequisites

- SEC-301 - Security Challenges in Modern AI Systems

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEC-302:00010	Model Robustness	Imported assessment	Assessment: Model Robustness: create a model	Apply	1, 2	1, 2
SEC-302:00020	AI System robustness	Imported assessment	Assessment: AI System robustness: write an essay to evaluate the system	Evaluate	2, 3, 6	2, 3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.9 SEN Pillar

2.9.1 Details for Competency SEN-101

SEN-101: Algorithmic Thinking & Problem Solving

Identity code: ALGO_THINKING_2

Required? Yes

Credits: 2 (Graded)

Description

This competency gives students practice in analyzing a problem, determining a solution and expressing that solution in terms of operations that can be executed by a computer program. It also introduces common notations for expressing algorithms, such as flowcharts and pseud-ocode, as well as analysis strategies like successive refinement.

Responsible Instructor: Sally Goldin

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-101:00010	Analysis techniques for program design	Hands-on problem	Turning verbal specifications into algorithms: Given a written specification for what a non-trivial program should do, create a detailed set of flowcharts and/or pseudocode that correctly expresses a solution	Analyze	2	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.9.2 Details for Competency SEN-102

SEN-102: Introduction to Programming

Identity code: INTRO_PROG.6

Required? Yes

Credits: 6 (Graded)

Description

This competency introduces students to core concepts in computer programming including conditionals, iteration, functional decomposition and so on, and illustrates how to use these constructs to create working programs. It also compares and contrasts the expression and use of the concepts in different programming languages.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-101 - Algorithmic Thinking & Problem Solving

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-102:00010	Controlling program flow	Hands-on problem	Assessment: Creating conditional structures: Write a non-trivial program based on a written specification that uses conditional logic to control processing	Create	1, 2	1, 2
SEN-102:00020	Controlling program flow	Hands-on problem	Assessment: Creating iteration structures: Write a non-trivial program based on a written specification that uses loop constructions	Create	1, 2	1, 2
SEN-102:00030	Functions and modules	Hands-on problem	Assessment: Creating reusable code units: Write a non-trivial program that uses functions, modules and (if relevant) packages to effectively distribute processing	Create	1, 2	1, 2
SEN-102:00040	Simple data structures	Hands-on problem	Assessment: Using arrays, structs, tuples, slices and other simple data structures: Given a written specification, write a non-trivial program that chooses and utilizes appropriate native data structures	Create	1, 2	1, 2
SEN-102:00050	Text files	Hands-on problem	Assessment: Text files: Write a program that reads and parses information from a text file, does some analysis on that data, and writes the results to a file with a different format.	Create	1, 2	1, 2
SEN-102:00060	Binary files and data	Hands-on problem	Using binary files: Given a problem description, write a program that will read information from a binary file, process that information, and write the data out to a new or modified binary file.	Create	1, 2	1, 2
SEN-102:00070	Comparing programming languages	Hands-on problem	Comparing programming languages: Given a problem description, write two programs, one in C and one in another programming language, that provide the same functionality.	Create	1, 2	1, 2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.9.3 Details for Competency SEN-103

SEN-103: Programming Multi-module Applications

Identity code: MULTIMODULE.4

Required? No

Credits: 4 (Graded)

Description

Using the principles of low coupling, high coherence and separation of concerns to design and implement software with multiple functional components, in a variety of scenarios single executable, multi co-located executables, components distributed across a network

Responsible Instructor: Fawad Asadi

Prerequisites

- SEN-102 - Introduction to Programming

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-103:00010	Single executable systems	Hands-on problem	Assessment: Create a simple multi-module, single executable system: Given a written specification for a software system, create a single executable, multi-module solution in C, Java and/or Python.	Create	1, 2	1, 2
SEN-103:00020	Multiple executable systems	Hands-on problem	Assessment: Create a simple software system with multiple communicating executables: Given a written specification for a software system, create a multi-module solution that uses communicating components written in multiple languages	Create	1, 2	1, 2
SEN-103:00030	Distributed systems	Hands-on problem	Assessment: Design a distributed multi-component system: Given a written description of its capabilities, design a web application including its components, interfaces and REST API	Analyze	2, 3	2, 3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.9.4 Details for Competency SEN-107

SEN-107: Fundamental Data Structures and Algorithms

Identity code: BASIC_DATA_STRUCT_6

Required? Yes

Credits: 6 (Graded)

Description

This competency introduces students to lists, queues, stacks, trees, hash tables and graphs, using the C language. It also covers basic concepts of computational complexity and simple algorithms for working with these data structures.

Responsible Instructor: Pasin Manurangsi

Prerequisites

- SEN-102 - Introduction to Programming

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-107:00010	Sequential data structures	Hands-on problem	Assessment: Sequential data structures: Create a program that uses general and special purpose (e.g. queues, stacks) lists to solve a specified problem	Create	1, 2	1, 2
SEN-107:00020	Recursive algorithms	Hands-on problem	Assessment: Recursive algorithms: Design and implement recursive algorithms that operate correctly on the contents of connected data structures such as trees or graphs.	Create	1	1
SEN-107:00030	Hierarchical data structures	Hands-on problem	Assessment: Hierarchical data structures: Create a program that implements a sorted binary tree. Use it to search and sort a set of data.	Create	1	1
SEN-107:00040	Hierarchical data structures	Hands-on problem	Assessment: Hierarchical data structures: Create a program that builds and uses a tree with an arbitrary branching factor, e.g.. a tree that represents folders and files on a hard disk or an organization chart.	Create	1	1
SEN-107:00050	Content-addressable data structure	Hands-on problem	Assessment: Content-addressable data structure: Write a program that uses hash tables to efficiently access data, using multiple categories of keys.	Create	1	1
SEN-107:00060	Graphs	Hands-on problem	Assessment: Graphs: Write a program that uses graph data structures to represent many-to-many relationships entered from the terminal or read from a file.	Create	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.9.5 Details for Competency SEN-109

SEN-109: Modern Systems Programming

Identity code: SYS.PROG_2

Required? No

Credits: 2 (Graded)

Description

This competency will introduce students to the fundamentals of modern systems programming in a memory safe language (Rust). This lecture/tutorial-based competency will cover basic and unique features of Rust language which can later be used for system-level programming. Topics include: - Accessing development ecosystem and toolchain for building, compiling and dependency handling - Application of basic control flow and structured data types - Utilizing of pattern matching, traits, generics and standard library to handle operations on different data types - Safe memory management using smart pointers, borrowing and lifetime concepts - Using iterators, modules, testing, error handling and unsafe Rust for system programming

Responsible Instructor: Akkarit Sangpetch

Prerequisites

- SEN-102 - Introduction to Programming

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-109:00010	Systems programming requirements and constraints	Hands-on problem	Understanding systems programming : Given some sample systems code, analyze to identify areas of vulnerability	Analyze	1	1
SEN-109:00020	Rust development ecosystem and toolchain	Hands-on problem	Use the Rust programming tool chain to build, execute, test, etc. a Rust program: As part of a larger development effort in Rust, use the compiler and other tools effectively to build, test and execute a Rust software system	Create	1, 2	1
SEN-109:00030	Safe memory management	Hands-on problem	Apply techniques to manage memory safely: Develop a non-trivial program in Rust that solves some systems-programming problem, using memory-safe constructions	Create	2	2
SEN-109:00040	Pattern matching, traits and generics	Hands-on problem	Apply Rust pattern matching constructions and generics: As part of a large programming effort in Rust, use pattern matching, traits and generics .	Create	2	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.9.6 Details for Competency SEN-208

SEN-208: Advanced Data Structures and Algorithms

Identity code: ADV_DATA_STRUCT_6

Required? No

Credits: 6 (Graded)

Description

No description provided

Responsible Instructor: Chutimet Srinilta

Prerequisites

- SEN-107 - Fundamental Data Structures and Algorithms

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-208:00010	Time complexity analysis	Quiz or exam	Analyzing asymptotic time complexity of non-recursive and recursive algorithms.: Given the pseudocode for an algorithm, determine the worst case time complexity and identify the component that contributes mainly to the overall running time.	Apply	1	1
SEN-208:00020	Non-linear data structures	Quiz or exam	Understanding the behavior of non-linear data structures and their strengths/weaknesses. Creating a solution using appropriate data structure.: Implement data structures and their basic operations. Choose an appropriate data structure for a given problem.	Apply	1	1
SEN-208:00030	Networks	Quiz or exam	Creating a solution that appropriately uses network data structures and algorithms.: Given a problem, design and implement a solution using a network data structure to solve it. Trace shortest path and minimum spanning tree algorithms.	Apply	1	1
SEN-208:00040	Sorting	Quiz or exam	Creating solutions using different sorting algorithms. Comparing their utility and performance.: Implement two sorting algorithms (one comparison-based algorithm and one divide-and-conquer algorithm). Design the experiments to demonstrate behavior, pros and cons, of the two sorting algorithms.	Apply	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.9.7 Details for Competency SEN-209

SEN-209: Designing and implementing databases

Identity code: DATABASES.6

Required? No

Credits: 6 (Graded)

Description

This competency introduces the basic principles of relational databases and techniques for using them in programs. It also includes conceptual modelling for database design and other database paradigms.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-107 - Fundamental Data Structures and Algorithms

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-209:00010	Database System Concepts, Database Architecture	Quiz or exam	[SEN-209:00010]Understand the concepts of logical and physical databases, query optimization, the 3-schema database architecture: Take a quiz that evaluates key distinctions and concepts on these topics.	Evaluate	1	1
SEN-209:00020	Relational table structure creation, including SQL DDL	Quiz or exam	[SEN-209:00020]Understand relational database model and relational database representations: Take a quiz that evaluates key distinctions and concepts on these topics. Create SQL tables and try some simple queries.	Evaluate	1	1
SEN-209:00030	Querying a relational database	Hands-on problem	[SEN-209:00030]Create and execute SQL queries to retrieve data: Create and execute SQL queries to retrieve data	Apply	1	1
SEN-209:00040	Data manipulations and transactions in a relational database	Quiz or exam	[SEN-209:00040]Add and modify data in a relational DB using SQL: Given a database with a known schema, which already contains data, create and execute SQL statements to add new records, modify existing records, and delete records, according to a set of instructions. Test basic transaction operations.	Apply	1	1
SEN-209:00050	Database operations in software	Quiz or exam	[SEN-209:00050]Write a program that queries and modifies a relational database: Write a program that queries and modifies a relational database Given a database with a known schema, which already contains data, write a program to retrieve specific information, add new records, modify existing records, and delete records, according to a set of instructions.	Apply	<i>None</i>	<i>None</i>
SEN-209:00060	Relational database analysis and quality control of the schemas	Quiz or exam	[SEN-209:00060]Database attributes analysis using the normalization technique, 1NF to 5NF: Take a quiz that evaluates key distinctions and concepts on these topics	Evaluate	<i>None</i>	<i>None</i>
SEN-209:00070	Database Design case study	Hands-on problem	[SEN-209:00070]Conceptual Modelling and Database Design: Given a case study, design a conceptual model and transform it into database structures	Apply	<i>None</i>	<i>None</i>
SEN-209:00080	Comparing database systems	Quiz or exam	[SEN-209:00080] Introduction to the NoSQL database paradigm: Write a report on a NoSQL database software and its application Given a description of a particular software application, decide what database system you would use. Explain and justify your choice in writing.	Understand	<i>None</i>	<i>None</i>

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.9.8 Details for Competency SEN-304

SEN-304: Object Oriented Design and Programming

Identity code: OO_PROG.6

Required? No

Credits: 6 (Graded)

Description

This competency introduces core principles of the object-oriented paradigm including classes and instances, member data and methods, encapsulation, inheritance, polymorphism, separation of concerns, etc. Students will work in pairs to create a UML-based design for a simple object-oriented system, then implement it in Java. Because this is a project-based class, all work must be completed by the end of the semester. It will not be possible to extend this competency.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-107 - Fundamental Data Structures and Algorithms

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-304:00010	Discovering classes	Hands-on problem	Discover classes: Use a problem specification to define a set of classes. Refine the classes using CRC cards	Analyze	2	2
SEN-304:00020	Encapsulation, inheritance and polymorphism	Hands-on problem	Use encapsulation, inheritance and polymorphism in a class hierarchy: Revise a set of classes to extract general structural or behavioral characteristics and to maximize data-hiding	Create	1	1
SEN-304:00030	Design using UML	Hands-on problem	Assessment: Design using UML: Create a use case diagram and a class diagram for an OO application. Create sequence diagrams for core interactions.	Create	2	2
SEN-304:00040	Design patterns	Hands-on problem	Apply design patterns: Analyze an OO design and identify opportunities for applying common design patterns.	Apply	1, 2	2
SEN-304:00050	Translating an object-oriented model into code	Hands-on problem	Translate an object-oriented model into code: Implement, test and debug the application represented by a UML design. Update the design diagrams to reflect any changes during implementation.	Create	1, 5	1, 5

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.9.9 Details for Competency SEN-305

SEN-305: Functional Programming

Identity code: FUNC_PROG_4

Required? No

Credits: 4 (Graded)

Description

Functional programming is a paradigm of building computer programs using expressions and functions without mutating state and data. By respecting these restrictions, functional programming aims to write code that is clearer to understand and more bug resistant.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-107 - Fundamental Data Structures and Algorithms

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-305:00010	Functional Programming	Hands-on problem	Use Functional Programming: Given a problem specification, use a functional programming approach to implement a solution. This can be done using a pure functional language like Haskell, or by applying the functional programming capabilities in Python or JavaScript.	Create	1, 2	1, 2
Category		Code	Learning Outcome			
Engineering SLO		1	Engineering problem solving			
		2	Designing to meet requirements			
		3	Effective communication			
		4	Ethical awareness			
		5	Teamwork			
		6	Experimental design and data analysis			
		7	Self-learning			
Computing SLO		1	Computational problem solving			
		2	Designing, implementing and evaluating from requirements			
		3	Effective communication			
		4	Ethical and professional awareness			
		5	Teamwork			

2.9.10 Details for Competency SEN-306

SEN-306: Dataflow Programming

Identity code: DATAFLOW_PROG_4

Required? No

Credits: 4 (Graded)

Description

In computer programming, dataflow programming is a programming paradigm that models a program as a directed graph of the data flowing between operations, thus implementing dataflow principles and architecture.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-107 - Fundamental Data Structures and Algorithms

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-306:00010	Dataflow Programming	Hands-on problem	Applying the dataflow programming paradigm: Given a written specification of a problem, write a program that uses a dataflow approach to solve that problem.	Create	1, 2	1, 2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.9.11 Details for Competency SEN-307

SEN-307: Domain-specific programming languages

Identity code: DSL.2

Required? No

Credits: 2 (Graded)

Description

Domain-specific programming languages are purposely designed to facilitate solving specific types of problems. DSLs can allow individuals who are not professional programmers to directly create their own solutions.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-107 - Fundamental Data Structures and Algorithms

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-307:00010	Domain-specific programming languages	Hands-on problem	Using domain-specific programming languages: Given a problem specification in some domain, identify an appropriate DSL and use that DSL to create a problem solution.	Create	1, 2	1, 2
Category		Code	Learning Outcome			
Engineering SLO		1	Engineering problem solving			
		2	Designing to meet requirements			
		3	Effective communication			
		4	Ethical awareness			
		5	Teamwork			
		6	Experimental design and data analysis			
		7	Self-learning			
Computing SLO		1	Computational problem solving			
		2	Designing, implementing and evaluating from requirements			
		3	Effective communication			
		4	Ethical and professional awareness			
		5	Teamwork			

2.9.12 Details for Competency SEN-201

SEN-201: Software Engineering Processes

Identity code: SE_PROCESSES_6

Required? Yes

Credits: 6 (Graded)

Description

This competency introduces the underlying goals of software engineering, namely to reduce complexity, increase predictability and improve software quality. It then provides a survey of the most fundamental software engineering processes that teams employ in order to achieve these goals. This is a project based course. Assessment will be based on activities and artifacts generated by each project team.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-107 - Fundamental Data Structures and Algorithms

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-201:00010	Problem definition processes	Hands-on problem	Assessment: Interview a stakeholder to create a problem definition for a software system: Given a general description of a software system to be built, interview a stakeholder (real stakeholder or a professor in that role) to elicit a problem description. Express the problem as a requirements list, a set of use cases, or both.	Analyze	2, 3	2, 3
SEN-201:00020	Design processes	Hands-on problem	Assessment: Create a high level architecture design for a system: Given a problem description for a software system, plus other constraints, create an architecture diagram and a corresponding description for that system.	Create	2, 3	2, 3
SEN-201:00030	Design processes	Hands-on problem	Assessment: Create a detailed design for a system component: Given a functional description for one component of a software system, create a detailed design for that component in the form of a sequence diagram plus an activity diagram.	Create	1, 3	1, 3
SEN-201:00040	Configuration management	Hands-on problem	Use SCM tools to solve common team development problems: Use a specific SCM (git, CVS, SVN etc.) to solve or avoid the problems in team development of a software system. Summarize standard SCM processes for your team.	Apply	5	5
SEN-201:00050	Software testing	Hands-on problem	Assessment: Software testing: Given a code module plus an explanation of what it is supposed to do, create unit tests for that module, using a framework of your choice. Run the unit test suite and fix any defects. Repeat until the unit tests all complete successfully. OR Apply static analysis tools to a code module and use the results to remedy defects.	Create	1, 5	1, 5
SEN-201:00060	Software testing	Hands-on problem	Assessment: Software testing: Given an actual software system, create a functional test plan you could use to verify that the system performs as specified. Then execute the test plan and document the results.	Create	1	1
SEN-201:00070	Deployment and maintenance	Hands-on problem	Assessment: Deployment and maintenance: Analyze the requirements for deploying a software system, then create a formal deployment plan that will install and configure the system on the target platform(s). Implement and test this plan, modifying if necessary, until the deployment is successful.	Create	1, 3	1, 3
SEN-201:00080	Software documentation	Hands-on problem	Assessment: Software documentation: Create a set of coding standards for a development team. Then add appropriate documentation to the code, following best practices, the standards of the language plus the standards for the team..	Create	5	5
SEN-201:00090	Software process paradigms	Hands-on problem	Assessment: Software process paradigms: Review your team's software development project and discuss 1) what process paradigm is closest to your processes for the project; 2) what paradigm you would choose if you were starting from scratch and 3) why you think that paradigm is appropriate.	Evaluate	3	3
SEN-201:00100	Motivation for software engineering	Hands-on problem	Assessment: Motivation for software engineering: Analyze and	Evaluate	2, 3	2, 3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.9.13 Details for Competency SEN-202

SEN-202: Software Quality Assurance

Identity code: SE.TESTING.4

Required? No

Credits: 4 (Graded)

Description

This competency explores the dimensions of software quality and important practices employed to enhance and measure quality. Topics include various types of testing, static and dynamic code analysis, design and code reviews, and QA components of Dev/Ops. Students will be expected to create a prototype QA process using modern QA tools.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-201 - Software Engineering Processes

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-202:00010	Software Quality Assurance	Hands-on problem	Assessment: Software Quality Assurance: Design a set of QA processes and apply to a software development project. Write a paper describing your process framework and evaluate the results.	Evaluate	1, 3, 5	1, 3, 5
Category		Code	Learning Outcome			
Engineering SLO		1	Engineering problem solving			
		2	Designing to meet requirements			
		3	Effective communication			
		4	Ethical awareness			
		5	Teamwork			
		6	Experimental design and data analysis			
		7	Self-learning			
Computing SLO		1	Computational problem solving			
		2	Designing, implementing and evaluating from requirements			
		3	Effective communication			
		4	Ethical and professional awareness			
		5	Teamwork			

2.9.14 Details for Competency SEN-203

SEN-203: Software Design

Identity code: SE_DESIGN_4

Required? No

Credits: 4 (Graded)

Description

This competency explores tools and techniques for designing software systems that are functionally correct, robust, efficient, usable and maintainable. We will emphasize core software engineering principles such as separation of concerns at all design levels.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-201 - Software Engineering Processes

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-203:00010	Design processes	Hands-on problem	Assessment: Design processes: Use tools, notations and processes to create a design for a software system.	Create	2	2
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.9.15 Details for Competency SEN-205

SEN-205: Requirements Analysis and Problem Definition

Identity code: REQ_ANALYSIS_2

Required? No

Credits: 2 (Graded)

Description

This competency will introduce techniques that software engineers can use to elicit, elaborate and document the requirements for a software system, that is, a description of what should be built and what problems the system should solve.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-201 - Software Engineering Processes

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-205:00010	Requirements Analysis and Problem Definition	Hands-on problem	Assessment: Requirements Analysis and Problem Definition: Create a problem analysis document for a software system	Analyze	2, 5	2, 5
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.9.16 Details for Competency SEN-212

SEN-212: Software Configuration Management

Identity code: SCM_2

Required? No

Credits: 2 (Graded)

Description

This competency explores the various scenarios that can arise during software development that require the capabilities provided by an SCM system and considers how different SCM approaches handle these scenarios.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-201 - Software Engineering Processes

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-212:00010	Software Configuration Management	Hands-on problem	Assessment: Software Configuration Management: Apply SCM in a real-world software project	Apply	1, 5	1, 5
Category		Code	Learning Outcome			
Engineering SLO		1	Engineering problem solving			
		2	Designing to meet requirements			
		3	Effective communication			
		4	Ethical awareness			
		5	Teamwork			
		6	Experimental design and data analysis			
		7	Self-learning			
Computing SLO		1	Computational problem solving			
		2	Designing, implementing and evaluating from requirements			
		3	Effective communication			
		4	Ethical and professional awareness			
		5	Teamwork			

2.9.17 Details for Competency SEN-213

SEN-213: Software Measurement

Identity code: SE.METRICS.2

Required? No

Credits: 2 (Graded)

Description

This competency addresses the problem of measuring attributes of software including level of correctness, performance, usability, complexity, etc. The goal is an empirical, data-driven approach to continuous software improvement.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-201 - Software Engineering Processes

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-213:00010	Software Measurement	Hands-on problem	Apply empirical strategies to improve software development: Software Measurement	Evaluate	6	None
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.9.18 Details for Competency SEN-214

SEN-214: Software Maintenance and Evolution

Identity code: SE.MAINTENANCE_2

Required? No

Credits: 2 (Graded)

Description

This competency identifies software engineering processes that facilitate the orderly evolution and maintenance of existing software systems, including continuous integration and continuous deployment (CI/CD), documentation, and regression testing.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-201 - Software Engineering Processes

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-214:00010	Software Maintenance and Evolution	Hands-on problem	Apply techniques for software maintenance and evolution: Given a real-world software project, identify and implement strategies and tools to make it more maintainable.	Apply	1, 5, 6	1, 5
Category		Code	Learning Outcome			
Engineering SLO		1	Engineering problem solving			
		2	Designing to meet requirements			
		3	Effective communication			
		4	Ethical awareness			
		5	Teamwork			
		6	Experimental design and data analysis			
		7	Self-learning			
Computing SLO		1	Computational problem solving			
		2	Designing, implementing and evaluating from requirements			
		3	Effective communication			
		4	Ethical and professional awareness			
		5	Teamwork			

2.9.19 Details for Competency SEN-301

SEN-301: Designing and Building Secure Software

Identity code: SECURE_SW_DESIGN_4

Required? No

Credits: 4 (Graded)

Description

This competency introduces practical techniques for reducing security vulnerabilities during the process of software design.

Responsible Instructor: Sally Goldin

Prerequisites

- SEC-201 - Data Privacy, Security and Integrity
- SEN-203 - Software Design

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-301:00010	Designing and Building Secure Software	Observational assessment	Designing and building Secure Software: Designing and Building Secure Software	Apply	2	2
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.9.20 Details for Competency SEN-302

SEN-302: Designing and Building Mission Critical Software

Identity code: MISSION_CRITICAL_SW_2

Required? No

Credits: 2 (Graded)

Description

"Mission critical" software is software with extremely high requirements for availability and correctness. Failures in mission critical software are likely to result in death or disasters. Examples include power-grid software, software embedded in medical devices and software used in space technology. Teams developing mission-critical software need to adopt processes that will allow them to meet these more stringent requirements.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-202 - Software Quality Assurance
- SEN-203 - Software Design

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-302:00010	Mission Critical Software Strategies	Hands-on problem	Apply strategies and processes appropriate for mission critical software : Given a problem description for a mission-critical application, design a detailed set of development processes to maximize safety and minimize risk. Document this design in a 10-15 page paper.	Analyze	1, 3	1, 3
Category		Code	Learning Outcome			
Engineering SLO		1	Engineering problem solving			
		2	Designing to meet requirements			
		3	Effective communication			
		4	Ethical awareness			
		5	Teamwork			
		6	Experimental design and data analysis			
		7	Self-learning			
Computing SLO		1	Computational problem solving			
		2	Designing, implementing and evaluating from requirements			
		3	Effective communication			
		4	Ethical and professional awareness			
		5	Teamwork			

2.9.21 Details for Competency SEN-401

SEN-401: Agile Development Processes (including DevOps)

Identity code: AGILE_SE_2

Required? No

Credits: 2 (Graded)

Description

Agile Development refers to a software development style which emphasizes self-organization of team work, fluid design, frequent iteration and visibility of status. An agile approach contrasts with more formal and rigid development process paradigms which attempt to fully document the requirements and design of a system before implementation begins. This competency will review several agile paradigms and give students the opportunity to experiment with their practices.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-201 - Software Engineering Processes

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-401:00010	Agile Development Processes (including DevOps)	Hands-on problem	Understand and apply Agile Development Processes: Engage in a set of group exercises that use various agile practices, then reflect on the experience and results.	Evaluate	3, 5	3, 5
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.9.22 Details for Competency SEN-402

SEN-402: Software Project Management

Identity code: SW_PROJ_MGMT_4

Required? No

Credits: 4 (Graded)

Description

This competency introduces students to the concepts and tools in "classical" software project management: task breakdowns, task dependencies, critical path method, resource allocation issues and so on. Upon completing the competency, a student will be equipped to plan and manage a small project.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-201 - Software Engineering Processes

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-402:00010	Software Project Management	Hands-on problem	Apply software project management techniques and tools: Given a simulated software development project, develop a project plan, monitor progress and make adjustments as necessary when faced with challenges to the plan.	Analyze	3	3
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.9.23 Details for Competency SEN-403

SEN-403: Software Organization Maturity and Continuous Improvement

Identity code: SW_MATURITY_2

Required? No

Credits: 2 (Graded)

Description

Carnegie Mellon’s Software Engineering Institute (SEI) created the CMMI model to evaluate the process maturity of software development organizations and to guide organizations toward higher levels of effectiveness. This competency will explore the key concepts of CMMI as well as the broader goal of continuous improvement, in order to prepare students to lead development efforts.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-213 - Software Measurement
- SEN-402 - Software Project Management

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-403:00010	Software Organization Maturity and Continuous Improvement	Hands-on problem	Apply the concepts of Software Organization Maturity and Continuous Improvement: Given a detailed case study of a software development organization, analyze the organization in terms of CMMI principles and provide an evaluation of its process maturity in different process areas.	Evaluate	3	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.9.24 Details for Competency SEN-404

SEN-404: Legacy Software Strategies

Identity code: LEGACY_SW.2

Required? No

Credits: 2 (Graded)

Description

Legacy software is software that uses old or outdated technologies, but which is too important or central to an organization to be discarded. This competency explores strategies for integrating legacy applications with new software while minimizing the negative consequences.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-201 - Software Engineering Processes
- SEN-103 - Programming Multi-module Applications

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-404:00010	Legacy Software Strategies	Hands-on problem	Apply effective legacy software strategies: Given a case study involving legacy software, propose a plan to successfully develop new applications that interface to or integrate with the legacy software.	Evaluate	1, 3	1, 3
Category		Code	Learning Outcome			
Engineering SLO		1	Engineering problem solving			
		2	Designing to meet requirements			
		3	Effective communication			
		4	Ethical awareness			
		5	Teamwork			
		6	Experimental design and data analysis			
		7	Self-learning			
Computing SLO		1	Computational problem solving			
		2	Designing, implementing and evaluating from requirements			
		3	Effective communication			
		4	Ethical and professional awareness			
		5	Teamwork			

2.9.25 Details for Competency SEN-405

SEN-405: Open Source Software

Identity code: OPENSOURCE_SW_2

Required? No

Credits: 2 (Graded)

Description

Open Source Software is software that is developed by a community of volunteers and made available, with its source code, for free. OSS has become very important to support continued advances in computing. Thus the quality of OSS is critically important. However, OSS development processes are distinctly different from those followed in formally constituted development teams.

Responsible Instructor: Sally Goldin

Prerequisites

- SEN-201 - Software Engineering Processes

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-405:00010	Open Source Software	Hands-on problem	Assessment: Open Source Software: Identify an open source project that interests you and join the development community. Contribute at least one code change. Then write an essay describing and analyzing the process of interacting with the OSS developers.	Evaluate	3, 5	3, 5

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.9.26 Details for Competency SEN-311

SEN-311: Web Architectures

Identity code: WEB_ARCH_4

Required? No

Credits: 4 (Graded)

Description

This competency surveys the core principles and typical components of a web application and considers various architectural patterns that can be used to build an application on the web.

Responsible Instructor: Isara Anantavrasilp

Prerequisites

- SEN-103 - Programming Multi-module Applications

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-311:00010	Fundamental concepts of web-based applications	Quiz or exam	Understand fundamental concepts of web-based applications: Take a quiz that evaluates key distinctions and concepts on these topics	Evaluate	3	3
SEN-311:00020	Basic knowledge on web development	Hands-on problem	Assessment: Basic knowledge on web development: Use HTML, CSS and Javascript, or a front-end framework, to develop a simple UI for a web application.	Apply	1, 2	1, 2
SEN-311:00030	Basic knowledge on web development	Hands-on problem	Assessment: Basic knowledge on web development: Given a problem description, create a backend web service that can compute and deliver solutions to that problem.	Create	1, 2	1, 2
SEN-311:00040	Basic knowledge on web development	Hands-on problem	Assessment: Basic knowledge on web development: Given the front-end and back-end code developed in previous assessments, integrate to create a full web application and demonstrate that it functions correctly.	Create	1, 2	1, 2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.9.27 Details for Competency SEN-312

SEN-312: Mobile Application Architectures

Identity code: MOBILE_ARCH.4

Required? No

Credits: 4 (Graded)

Description

This competency introduces the basic principles of mobile application architecture as well as some strategies for mobile application development, focusing on what makes a mobile app different from and more challenging than a web application.

Responsible Instructor: Isara Anantavrasilp

Prerequisites

- SEN-103 - Programming Multi-module Applications

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SEN-312:00010	Fundamental concepts of mobile applications	Quiz or exam	Understanding the fundamental concepts of UML: Take a quiz to demonstrate understanding of UML diagrams key to mobile development	Apply	3	3
SEN-312:00020	Fundamental concepts of mobile applications	Hands-on problem	Assessment: Fundamental concepts of mobile applications: Use UML to design a UI component for a mobile application	Create	1	1
SEN-312:00030	Fundamental concepts of mobile applications	Quiz or exam	Applyi fundamental concepts of mobile applications: Take a quiz that evaluates key distinctions and concepts on these topics	Analyze	3	3
SEN-312:00040	Basic knowledge on mobile app development	Hands-on problem	Assessment: Basic knowledge on mobile app development: Given a simple problem, develop a React Native app to solve that problem. Run the app on an actual device or simulator	Create	1, 2	1, 2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.10 SOF Pillar

2.10.1 Details for Competency SOF-101

SOF-101: Adaptability - Semester 1

Identity code: ADAPTABILITY_1_0

Required? Yes

Credits: 0 (Graded)

Description

Adaptability is the ability and willingness to adjust one's goals, actions and attitudes when necessary in the face of obstacles or evidence for better outcomes. It includes creative flexibility, adjusting or modifying ideas, designs, processes, decisions and other aspects of products or deliverables, and working flexibility, adjusting or modifying one's behavior to fit better into the team processes or to achieve better results.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-101:00010	Adaptability	Observational assessment	Assessment: Adaptability: Behavioral evaluation by faculty and self-assessment	Apply	5	5

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.10.2 Details for Competency SOF-102

SOF-102: Adaptability - Semester 2

Identity code: ADAPTABILITY_2_0

Required? Yes

Credits: 0 (Graded)

Description

Adaptability is the ability and willingness to adjust one's goals, actions and attitudes when necessary in the face of obstacles or evidence for better outcomes. It includes creative flexibility, adjusting or modifying ideas, designs, processes, decisions and other aspects of products or deliverables, and working flexibility, adjusting or modifying one's behavior to fit better into the team processes or to achieve better results.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-102:00010	Adaptability	Observational assessment	Assessment: Adaptability: Behavioral evaluation by faculty and self-assessment	Apply	5	5
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.3 Details for Competency SOF-103

SOF-103: Adaptability - Semester 3

Identity code: ADAPTABILITY_3_0

Required? Yes

Credits: 0 (Graded)

Description

Adaptability is the ability and willingness to adjust one's goals, actions and attitudes when necessary in the face of obstacles or evidence for better outcomes. It includes creative flexibility, adjusting or modifying ideas, designs, processes, decisions and other aspects of products or deliverables, and working flexibility, adjusting or modifying one's behavior to fit better into the team processes or to achieve better results.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-103:00010	Adaptability	Observational assessment	Assessment: Adaptability: Behavioral evaluation by faculty and self-assessment	Apply	5	5
Category		Code	Learning Outcome			
Engineering SLO		1	Engineering problem solving			
		2	Designing to meet requirements			
		3	Effective communication			
		4	Ethical awareness			
		5	Teamwork			
		6	Experimental design and data analysis			
		7	Self-learning			
Computing SLO		1	Computational problem solving			
		2	Designing, implementing and evaluating from requirements			
		3	Effective communication			
		4	Ethical and professional awareness			
		5	Teamwork			

2.10.4 Details for Competency SOF-104

SOF-104: Adaptability - Semester 4

Identity code: ADAPTABILITY_4_0

Required? Yes

Credits: 0 (Graded)

Description

Adaptability is the ability and willingness to adjust one's goals, actions and attitudes when necessary in the face of obstacles or evidence for better outcomes. It includes creative flexibility, adjusting or modifying ideas, designs, processes, decisions and other aspects of products or deliverables, and working flexibility, adjusting or modifying one's behavior to fit better into the team processes or to achieve better results.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-104:00010	Adaptability	Observational assessment	Assessment: Adaptability: Behavioral evaluation by faculty and self-assessment	Apply	5	5
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.5 Details for Competency SOF-201

SOF-201: Empathy - Semester 1

Identity code: EMPATHY_1_0

Required? Yes

Credits: 0 (Graded)

Description

Empathy is willingness and ability to adopt the perspective of someone else in order to understand that person's goals, attitudes, desires, and fears, as well as their possible cognitive or perceptual limitations. Empathy includes a human-centered focus, that is, an approach to design, development and problem solving that gives priority to users' or stakeholders' comfort, well-being and achievement of goals. Empathy also requires respect for diversity, that is, a recognition that individuals differ on a wide variety of dimensions including age, gender, ethnicity, culture, physical and cognitive ability, and so on, and that design, development and problem solving should produce outcomes that accommodate these differences.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-201:00010	Empathy	Observational assessment	Assessment: Empathy: Behavioral evaluation by faculty and self-assessment	Apply	4	4
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.6 Details for Competency SOF-202

SOF-202: Empathy - Semester 2

Identity code: EMPATHY.2.0

Required? Yes

Credits: 0 (Graded)

Description

Empathy is willingness and ability to adopt the perspective of someone else in order to understand that person's goals, attitudes, desires, and fears, as well as their possible cognitive or perceptual limitations. Empathy includes a human-centered focus, that is, an approach to design, development and problem solving that gives priority to users' or stakeholders' comfort, well-being and achievement of goals. Empathy also requires respect for diversity, that is, a recognition that individuals differ on a wide variety of dimensions including age, gender, ethnicity, culture, physical and cognitive ability, and so on, and that design, development and problem solving should produce outcomes that accommodate these differences.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-202:00010	Empathy	Observational assessment	Assessment: Empathy: Behavioral evaluation by faculty and self-assessment	Apply	4	4
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.7 Details for Competency SOF-203

SOF-203: Empathy - Semester 3

Identity code: EMPATHY.3.0

Required? Yes

Credits: 0 (Graded)

Description

Empathy is willingness and ability to adopt the perspective of someone else in order to understand that person's goals, attitudes, desires, and fears, as well as their possible cognitive or perceptual limitations. Empathy includes a human-centered focus, that is, an approach to design, development and problem solving that gives priority to users' or stakeholders' comfort, well-being and achievement of goals. Empathy also requires respect for diversity, that is, a recognition that individuals differ on a wide variety of dimensions including age, gender, ethnicity, culture, physical and cognitive ability, and so on, and that design, development and problem solving should produce outcomes that accommodate these differences.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-203:00010	Empathy	Observational assessment	Assessment: Empathy: Behavioral evaluation by faculty and self-assessment	Apply	4	4
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.8 Details for Competency SOF-204

SOF-204: Empathy - Semester 4

Identity code: EMPATHY_4_0

Required? Yes

Credits: 0 (Graded)

Description

Empathy is willingness and ability to adopt the perspective of someone else in order to understand that person's goals, attitudes, desires, and fears, as well as their possible cognitive or perceptual limitations. Empathy includes a human-centered focus, that is, an approach to design, development and problem solving that gives priority to users' or stakeholders' comfort, well-being and achievement of goals. Empathy also requires respect for diversity, that is, a recognition that individuals differ on a wide variety of dimensions including age, gender, ethnicity, culture, physical and cognitive ability, and so on, and that design, development and problem solving should produce outcomes that accommodate these differences.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-204:00010	Empathy	Observational assessment	Assessment: Empathy: Behavioral evaluation by faculty and self-assessment	Apply	4	4
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.9 Details for Competency SOF-301

SOF-301: Ethics - Semester 1

Identity code: ETHICS.1_0

Required? Yes

Credits: 0 (Graded)

Description

“Computing professionals’ actions change the world. To act responsibly, they should reflect upon the wider impacts of their work, consistently supporting the public good.” (Preamble, the ACM Code of Ethics) Note that according to this definition, acting out of awareness of the human and social impacts of computing falls under the soft skill of ethical behavior. Ethics encompasses multiple dimensions: social consciousness, the practice of making choices based on a consideration of what will provide the highest level of social good; honesty, which includes being trustworthy and transparent about reasons, actions and outcomes; fairness, a predisposition to treat all individuals equally and to avoid discrimination; respect for privacy and confidentiality, an active effort to protect information that should be treated as privileged, or that is explicitly identified as not to be disclosed.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-301:00010	Ethics	Observational assessment	Assessment: Ethics : Behavioral evaluation by faculty and self-assessment	Apply	4	4
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.10 Details for Competency SOF-302

SOF-302: Ethics - Semester 2

Identity code: ETHICS.2_0

Required? Yes

Credits: 0 (Graded)

Description

“Computing professionals’ actions change the world. To act responsibly, they should reflect upon the wider impacts of their work, consistently supporting the public good.” (Preamble, the ACM Code of Ethics) Note that according to this definition, acting out of awareness of the human and social impacts of computing falls under the soft skill of ethical behavior. Ethics encompasses multiple dimensions: social consciousness, the practice of making choices based on a consideration of what will provide the highest level of social good; honesty, which includes being trustworthy and transparent about reasons, actions and outcomes; fairness, a predisposition to treat all individuals equally and to avoid discrimination; respect for privacy and confidentiality, an active effort to protect information that should be treated as privileged, or that is explicitly identified as not to be disclosed.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-302:00010	Ethics	Observational assessment	Assessment: Ethics : Behavioral evaluation by faculty and self-assessment	Apply	4	4
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.11 Details for Competency SOF-303

SOF-303: Ethics - Semester 3

Identity code: ETHICS.3_0

Required? Yes

Credits: 0 (Graded)

Description

“Computing professionals’ actions change the world. To act responsibly, they should reflect upon the wider impacts of their work, consistently supporting the public good.” (Preamble, the ACM Code of Ethics) Note that according to this definition, acting out of awareness of the human and social impacts of computing falls under the soft skill of ethical behavior. Ethics encompasses multiple dimensions: social consciousness, the practice of making choices based on a consideration of what will provide the highest level of social good; honesty, which includes being trustworthy and transparent about reasons, actions and outcomes; fairness, a predisposition to treat all individuals equally and to avoid discrimination; respect for privacy and confidentiality, an active effort to protect information that should be treated as privileged, or that is explicitly identified as not to be disclosed.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-303:00010	Ethics	Observational assessment	Assessment: Ethics : Behavioral evaluation by faculty and self-assessment	Apply	4	4
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.12 Details for Competency SOF-304

SOF-304: Ethics - Semester 4

Identity code: ETHICS.4_0

Required? Yes

Credits: 0 (Graded)

Description

“Computing professionals’ actions change the world. To act responsibly, they should reflect upon the wider impacts of their work, consistently supporting the public good.” (Preamble, the ACM Code of Ethics) Note that according to this definition, acting out of awareness of the human and social impacts of computing falls under the soft skill of ethical behavior. Ethics encompasses multiple dimensions: social consciousness, the practice of making choices based on a consideration of what will provide the highest level of social good; honesty, which includes being trustworthy and transparent about reasons, actions and outcomes; fairness, a predisposition to treat all individuals equally and to avoid discrimination; respect for privacy and confidentiality, an active effort to protect information that should be treated as privileged, or that is explicitly identified as not to be disclosed.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-304:00010	Ethics	Observational assessment	Assessment: Ethics : Behavioral evaluation by faculty and self-assessment	Apply	4	4
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.13 Details for Competency SOF-401

SOF-401: Proactiveness - Semester 1

Identity code: PROACTIVE_1_0

Required? Yes

Credits: 0 (Graded)

Description

Proactiveness is a forward-looking attitude that anticipates possible problems or tasks. Proactive individuals act in anticipation of future needs rather than waiting passively to respond to situations as they arise. Proactiveness includes a service orientation, that is, a tendency to offer help or to take on responsibilities when there is a perceived need, and a focus on continuous improvement, that is, a constant awareness that every situation or process, no matter how successful, can be made better.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-401:00010	Proactiveness	Observational assessment	Assessment: Proactiveness : Behavioral evaluation by faculty and self-assessment	Apply	<i>None</i>	<i>None</i>
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.14 Details for Competency SOF-402

SOF-402: Proactiveness - Semester 2

Identity code: PROACTIVE.2_0

Required? Yes

Credits: 0 (Graded)

Description

Proactiveness is a forward-looking attitude that anticipates possible problems or tasks. Proactive individuals act in anticipation of future needs rather than waiting passively to respond to situations as they arise. Proactiveness includes a service orientation, that is, a tendency to offer help or to take on responsibilities when there is a perceived need, and a focus on continuous improvement, that is, a constant awareness that every situation or process, no matter how successful, can be made better.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-402:00010	Proactiveness	Observational assessment	Assessment: Proactiveness : Behavioral evaluation by faculty and self-assessment	Apply	<i>None</i>	<i>None</i>
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.15 Details for Competency SOF-403

SOF-403: Proactiveness - Semester 3

Identity code: PROACTIVE_3_0

Required? Yes

Credits: 0 (Graded)

Description

Proactiveness is a forward-looking attitude that anticipates possible problems or tasks. Proactive individuals act in anticipation of future needs rather than waiting passively to respond to situations as they arise. Proactiveness includes a service orientation, that is, a tendency to offer help or to take on responsibilities when there is a perceived need, and a focus on continuous improvement, that is, a constant awareness that every situation or process, no matter how successful, can be made better.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-403:00010	Proactiveness	Observational assessment	Assessment: Proactiveness : Behavioral evaluation by faculty and self-assessment	Apply	<i>None</i>	<i>None</i>
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.16 Details for Competency SOF-404

SOF-404: Proactiveness - Semester 4

Identity code: PROACTIVE_4_0

Required? Yes

Credits: 0 (Graded)

Description

Proactiveness is a forward-looking attitude that anticipates possible problems or tasks. Proactive individuals act in anticipation of future needs rather than waiting passively to respond to situations as they arise. Proactiveness includes a service orientation, that is, a tendency to offer help or to take on responsibilities when there is a perceived need, and a focus on continuous improvement, that is, a constant awareness that every situation or process, no matter how successful, can be made better.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-404:00010	Proactiveness	Observational assessment	Assessment: Proactiveness : Behavioral evaluation by faculty and self-assessment	Apply	<i>None</i>	<i>None</i>
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.17 Details for Competency SOF-501

SOF-501: Professionalism - Semester 1

Identity code: PROFESSIONAL_1_0

Required? Yes

Credits: 0 (Graded)

Description

Professionalism means demonstrating behavior that is appropriate to a working environment, effective in achieving the goals of one's organization, and consistent with the expectations of one's organization. Acting professionally includes: taking responsibility by making and keeping commitments; complying with organizational norms regarding appropriate action or behavior, for instance, following a dress code or recording one's working hours; managing time effectively in order to complete committed work; focusing on quality in all work products; demonstrating professional awareness as a representative of the larger community of computer practitioners; interacting with colleagues in an honest, respectful and productive manner.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-501:00010	Professionalism	Observational assessment	Assessment: Professionalism : Behavioral evaluation by faculty and self-assessment	Apply	<i>None</i>	<i>None</i>
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.18 Details for Competency SOF-502

SOF-502: Professionalism - Semester 2

Identity code: PROFESSIONAL_2_0

Required? Yes

Credits: 0 (Graded)

Description

Professionalism means demonstrating behavior that is appropriate to a working environment, effective in achieving the goals of one's organization, and consistent with the expectations of one's organization. Acting professionally includes: taking responsibility by making and keeping commitments; complying with organizational norms regarding appropriate action or behavior, for instance, following a dress code or recording one's working hours; managing time effectively in order to complete committed work; focusing on quality in all work products; demonstrating professional awareness as a representative of the larger community of computer practitioners; interacting with colleagues in an honest, respectful and productive manner.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-502:00010	Professionalism	Observational assessment	Assessment: Professionalism : Behavioral evaluation by faculty and self-assessment	Apply	<i>None</i>	<i>None</i>
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.19 Details for Competency SOF-503

SOF-503: Professionalism - Semester 3

Identity code: PROFESSIONAL_3_0

Required? Yes

Credits: 0 (Graded)

Description

Professionalism means demonstrating behavior that is appropriate to a working environment, effective in achieving the goals of one's organization, and consistent with the expectations of one's organization. Acting professionally includes: taking responsibility by making and keeping commitments; complying with organizational norms regarding appropriate action or behavior, for instance, following a dress code or recording one's working hours; managing time effectively in order to complete committed work; focusing on quality in all work products; demonstrating professional awareness as a representative of the larger community of computer practitioners; interacting with colleagues in an honest, respectful and productive manner.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-503:00010	Professionalism	Observational assessment	Assessment: Professionalism : Behavioral evaluation by faculty and self-assessment	Apply	<i>None</i>	<i>None</i>
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.20 Details for Competency SOF-504

SOF-504: Professionalism - Semester 4

Identity code: PROFESSIONAL_4_0

Required? Yes

Credits: 0 (Graded)

Description

Professionalism means demonstrating behavior that is appropriate to a working environment, effective in achieving the goals of one's organization, and consistent with the expectations of one's organization. Acting professionally includes: taking responsibility by making and keeping commitments; complying with organizational norms regarding appropriate action or behavior, for instance, following a dress code or recording one's working hours; managing time effectively in order to complete committed work; focusing on quality in all work products; demonstrating professional awareness as a representative of the larger community of computer practitioners; interacting with colleagues in an honest, respectful and productive manner.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-504:00010	Professionalism	Observational assessment	Assessment: Professionalism : Behavioral evaluation by faculty and self-assessment	Apply	<i>None</i>	<i>None</i>
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.21 Details for Competency SOF-601

SOF-601: Self-Learning - Semester 1

Identity code: SELF_LEARNING_1.0

Required? Yes

Credits: 0 (Graded)

Description

Self-learning involves recognizing that computer engineering and AI are constantly changing, and that one needs to be constantly expanding one's knowledge and skills. Self-learning includes the willingness to seek out information and the ability to apply new learning to current real-world tasks, as well as effectiveness in finding new knowledge and acquiring new skills.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-601:00010	Self-Learning	Observational assessment	Assessment: Self-Learning: Behavioral evaluation by faculty and self-assessment	Apply	7	None
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.22 Details for Competency SOF-602

SOF-602: Self-learning - Semester 2

Identity code: SELF_LEARNING_2.0

Required? Yes

Credits: 0 (Graded)

Description

Self-learning involves recognizing that computer engineering and AI are constantly changing, and that one needs to be constantly expanding one's knowledge and skills. Self-learning includes the willingness to seek out information and the ability to apply new learning to current real-world tasks, as well as effectiveness in finding new knowledge and acquiring new skills.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-602:00010	Self-Learning	Observational assessment	Assessment: Self-Learning: Behavioral evaluation by faculty and self-assessment	Apply	7	None
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.23 Details for Competency SOF-603

SOF-603: Self-learning - Semester 3

Identity code: SELF_LEARNING_3.0

Required? Yes

Credits: 0 (Graded)

Description

Self-learning involves recognizing that computer engineering and AI are constantly changing, and that one needs to be constantly expanding one's knowledge and skills. Self-learning includes the willingness to seek out information and the ability to apply new learning to current real-world tasks, as well as effectiveness in finding new knowledge and acquiring new skills.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-603:00010	Self-Learning	Observational assessment	Assessment: Self-Learning: Behavioral evaluation by faculty and self-assessment	Apply	7	None
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.24 Details for Competency SOF-604

SOF-604: Self-learning - Semester 4

Identity code: SELF_LEARNING_4.0

Required? Yes

Credits: 0 (Graded)

Description

Self-learning involves recognizing that computer engineering and AI are constantly changing, and that one needs to be constantly expanding one's knowledge and skills. Self-learning includes the willingness to seek out information and the ability to apply new learning to current real-world tasks, as well as effectiveness in finding new knowledge and acquiring new skills.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-604:00010	Self-Learning	Observational assessment	Assessment: Self-Learning: Behavioral evaluation by faculty and self-assessment	Apply	7	None
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.25 Details for Competency SOF-701

SOF-701: Teamwork - Semester 1

Identity code: TEAMWORK_1_0

Required? Yes

Credits: 0 (Graded)

Description

Teamwork skills involve behavior and attitudes that enhance both the effectiveness and the morale of groups with whom one works. Aspects of teamwork include: paying attention to the needs and goals of the team; acting with respect and courtesy toward all team members; being open and willing to share information or ideas with team members; showing team spirit, that is, valuing the team as a unit with shared commitments and dedication.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-701:00010	Teamwork	Observational assessment	Assessment: Teamwork : Behavioral evaluation by faculty and self-assessment	Apply	5	5
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.26 Details for Competency SOF-702

SOF-702: Teamwork - Semester 2

Identity code: TEAMWORK_2.0

Required? Yes

Credits: 0 (Graded)

Description

Teamwork skills involve behavior and attitudes that enhance both the effectiveness and the morale of groups with whom one works. Aspects of teamwork include: paying attention to the needs and goals of the team; acting with respect and courtesy toward all team members; being open and willing to share information or ideas with team members; showing team spirit, that is, valuing the team as a unit with shared commitments and dedication.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-702:00010	Teamwork	Observational assessment	Assessment: Teamwork : Behavioral evaluation by faculty and self-assessment	Apply	5	5
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.27 Details for Competency SOF-703

SOF-703: Teamwork - Semester 3

Identity code: TEAMWORK_3.0

Required? Yes

Credits: 0 (Graded)

Description

Teamwork skills involve behavior and attitudes that enhance both the effectiveness and the morale of groups with whom one works. Aspects of teamwork include: paying attention to the needs and goals of the team; acting with respect and courtesy toward all team members; being open and willing to share information or ideas with team members; showing team spirit, that is, valuing the team as a unit with shared commitments and dedication.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-703:00010	Teamwork	Observational assessment	Assessment: Teamwork : Behavioral evaluation by faculty and self-assessment	Apply	5	5
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.10.28 Details for Competency SOF-704

SOF-704: Teamwork - Semester 4

Identity code: TEAMWORK_4.0

Required? Yes

Credits: 0 (Graded)

Description

Teamwork skills involve behavior and attitudes that enhance both the effectiveness and the morale of groups with whom one works. Aspects of teamwork include: paying attention to the needs and goals of the team; acting with respect and courtesy toward all team members; being open and willing to share information or ideas with team members; showing team spirit, that is, valuing the team as a unit with shared commitments and dedication.

Responsible Instructor: Apirujee Rujirek

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SOF-704:00010	Teamwork	Observational assessment	Assessment: Teamwork : Behavioral evaluation by faculty and self-assessment	Apply	5	5
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.11 SYS Pillar

2.11.1 Details for Competency SYS-101

SYS-101: Operating Systems

Identity code: OS_UNIX_4

Required? Yes

Credits: 4 (Graded)

Description

This competency provides an overview of operating systems responsibilities & required mechanisms for multitasking and resource management of a computer system. This competency will focus on the virtualization abstraction and concurrency aspect of operating systems.

Responsible Instructor: Akkarit Sangpetch

Prerequisites

- SEN-102 - Introduction to Programming

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SYS-101:00010	Principles of Operating Systems	Imported assessment	Assessment: Implement and Use an OS Shell: Implement a Linux shell that interacts with file system, processes and signal handling	Apply	1, 2	1, 2
SYS-101:00020	Virtualization	Imported assessment	Assessment:Design and Implement a basic OS kernel: Implement a simplified OS kernel that can manage multiple processes and virtual memory	Remember	1, 2	1, 2
SYS-101:00030	Concurrency	Imported assessment	Assessment:Design and Implement a concurrent network server: Implement a client-server backend service that demonstrates useful synchronized data structure for network applications	Understand	1, 2	1, 2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.11.2 Details for Competency SYS-102

SYS-102: Basic Computer Architecture

Identity code: COMPUTER_ARCH.4

Required? Yes

Credits: 4 (Graded)

Description

Understanding how a computer program being execute on the hardware

Responsible Instructor: Akkarit Sangpetch

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SYS-102:00040	Programming interrupt-driven I/O	Hands-on problem	Interrupt-driven programming : Given a problem, design and implement a program for a chosen processor that solves the problem using interrupt service routines to handle events asynchronously	Remember	1, 2	1, 2
SYS-102:00060	State machines	Hands-on problem	State machine design: Given a problem description, devise a state machine that solves the problem, and implement an equivalent circuit using digital elements through truth table analysis	Create	1, 2	2
SYS-102:00070	Processor architecture	Hands-on problem	Computer architecture: Given an example set of instructions, design a processor data path that can execute those instructions.	Apply	1	1
SYS-102:00080	Assembly language programming	Hands-on problem	Assembly Programming: Given a problem, design and implement a program in assembly language for a chosen processor that solve the problem	Apply	1	2
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.11.3 Details for Competency SYS-202

SYS-202: Real Time Operating Systems

Identity code: RT_OS.4

Required? No

Credits: 4 (Graded)

Description

No description provided

Responsible Instructor: Akkarit Sangpetch

Prerequisites

- SYS-101 - Operating Systems

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SYS-202:00010	Real Time Operating Systems	Hands-on problem	Apply Memory, Task, and Threading Management in RTOS: Hands-on assignment to install RTOS on the prepared environment by using CLI and tools.	Apply	1, 2, 7	1, 2
SYS-202:00020	Real Time Operating Systems	Hands-on problem	Create real-time programs to run on RTOS: Hand-on assignment to program an application to run on RTOS.	Create	1, 2, 6, 7	1, 2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.11.4 Details for Competency SYS-205

SYS-205: Storage and File Systems Fundamentals

Identity code: FILE_SYSTEMS.2

Required? No

Credits: 2 (Graded)

Description

Many useful applications (e.g., deep learning, data mining, video editing) require data that usually exceed the capacity of main memory (e.g., SRAM, DRAM) in many computer systems. Without additional storage devices (i.e., secondary storage), computer systems would not support those applications. However, computer systems should also handle those devices efficiently in order to maximize applications' performance while ensuring data integrity according to how users generally use them.

This competency will equip you with skills to understand and be able to apply the knowledge of how computer systems are designed and implemented to interact with persistent storage devices (i.e., hard disk drives, solid state drives) efficiently. This includes device management, basic file system operations, and basic file system designs and implementations.

Responsible Instructor: Akkarit Sangpetch

Prerequisites

- SYS-101 - Operating Systems
- SYS-102 - Basic Computer Architecture

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SYS-205:00010	Storage management	Hands-on problem	Create a simple device driver: Students will implement a simple character device driver based on a given specification.	Understand	1, 2	1, 2
SYS-205:00020	Storage management	Imported assessment	Analyze impacts of different persistent storage devices to an application: Students will write essays to demonstrate their understanding.	Analyze	1	1
SYS-205:00030	File system	Hands-on problem	Apply file system operations in programming: Given a file format specification. Students must develop a program that reads/write certain parts of the file to compute/store data without using any third-party APIs.	Apply	1, 2	1, 2
SYS-205:00040	File system	Hands-on problem	Create a simple file system: Students will implement a simple file system based on a given specification. This includes implementing data structures and common file system operations (e.g., open, read, write, delete, ln).	Understand	1, 2	1, 2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.11.5 Details for Competency SYS-206

SYS-206: Computer Design Processor Architectures and Digital Design

Identity code: DIGITAL_DESIGN_4

Required? No

Credits: 4 (Graded)

Description

This course explores the fundamentals of processor architecture and digital design, covering topics like instruction sets, pipelining, and memory hierarchy. Students will design and simulate processors using HDL and implement components on FPGA hardware. Emphasis is placed on performance optimization, energy efficiency, and practical applications in computing systems.

Responsible Instructor: Wanarat Suntiamorntut

Prerequisites

- SYS-102 - Basic Computer Architecture

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SYS-206:00010	concepts of computer design	Hands-on problem	Understand fundamental concepts of computer design: Find and explain an example of each computer architecture type, discussing and evaluating the performance, Pros and Cons.	Analyze	3, 7	3
SYS-206:00020	Instruction Set Architecture	Hands-on problem	Create the ISA to meet the requirements: Given the c code which is expected to run on the computer, design the ISA and implement the computer architecture to operate that "C" code.	Create	2	2
SYS-206:00030	Data path and control unit, Arithmetic and logic unit, Computer	Hands-on problem	Build a simple processor and evaluate it using simulation at RTL level: Create a simple processor using Hardware Description Language (HDL) and do the functional testing using RTL simulator	Create	2	2
SYS-206:00040	Fundamental concept of AI Processor design	Hands-on problem	Explore the new computer architectures that transcend traditional computer architecture: Explore and explain the concept of new computer architectures for AI and discussing the Pros and Cons.	Understand	3, 7	3

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.11.6 Details for Competency SYS-207

SYS-207: Networks

Identity code: NETWORKS_4

Required? No

Credits: 4 (Graded)

Description

Network architecture, OSI

Responsible Instructor: Paisarn Sonthikorn

Prerequisites

- SYS-102 - Basic Computer Architecture

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SYS-207:00010	Protocol stacks	Imported assessment	Assessment: Implement a network application using the network protocol stacks method for potential services.: Create a socket-based network application	Create	None	None
SYS-207:00020	Routing algorithms	Imported assessment	Assessment: Understand routing algorithms method for potential services.: Describe and show an example how a particular routing algorithm works	Understand	None	None
SYS-207:00030	Wireless network	Imported assessment	Assessment: Understand wireless network and its deployment scenario: Describe how medium access control can be achieved using wireless network	Understand	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.11.7 Details for Competency SYS-208

SYS-208: Digital and Analog Circuit Design

Identity code: CIRCUIT_DESIGN_4

Required? No

Credits: 4 (Graded)

Description

This course introduces the integration of analog and digital systems by creating Direct Digital Synthesis Function Generator

Responsible Instructor: Sumek Wisayataksin

Prerequisites

- SYS-102 - Basic Computer Architecture

Distribution Areas

- Core Technical

Skills and Assessments None specified.

2.11.8 Details for Competency SYS-301

SYS-301: Cyber Physical Systems

Identity code: CYBER_PHYS_SYS_4

Required? No

Credits: 4 (Graded)

Description

No description provided

Responsible Instructor: Akkarit Sangpetch

Prerequisites

- SYS-102 - Basic Computer Architecture

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SYS-301:00010	Fundamental of Cyber-Physical Systems	Quiz or exam	Assessment: Fundamental of Cyber-Physical Systems: Take a quiz that evaluates key distinctions and concepts on these topics	Understand	1	1
SYS-301:00020	Embedded Systems	Quiz or exam	Assessment: Embedded Systems: Take a quiz that evaluates key distinctions and concepts on these topics	Evaluate	1	1
SYS-301:00030	Embedded Systems	Quiz or exam	Assessment: Embedded Systems: Assign programming assignments to demonstrate the ability of basic programming language	Remember	1	1
SYS-301:00040	Control System	Quiz or exam	Assessment: Control System: Basic Control Theory, Controller Designs with examples of PID and Kalman Filter Applications	Apply	1	1
SYS-301:00050	Sensors and Actuators	Quiz or exam	Assessment: Sensors and Actuators: Assign individual/group projects to demonstrate the ability to design a cyber-physical system model for real applications.	Create	6	2

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.11.9 Details for Competency SYS-302

SYS-302: Cloud Computing

Identity code: CLOUD_COMP_4

Required? No

Credits: 4 (Graded)

Description

No description provided

Responsible Instructor: Akkarit Sangpetch

Prerequisites

None

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SYS-302:00010	Cloud computing overview	Quiz or exam	Describe Key Components of Cloud Computing: Take a quiz that evaluates key distinctions and concepts on these topics	Remember	3, 6, 7	3
SYS-302:00070	Concept of delivery& deployment model	Quiz or exam	Architect a cloud-based service considering the delivery model, pricing, security, and service level agreement: Evaluate existing cloud service offerings; determine the delivery models and describe how the services can be utilized to support designated applications	Understand	3, 4, 7	1, 4
SYS-302:00090	Application of cloud computing technology	Quiz or exam	Deploy and maintain a service using cloud computing technologies: Deploy, monitor and evaluate the performance of a service on the cloud. Practicing DevOps to manage and scale on-demand service.	Understand	3, 4, 7	1, 4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.11.10 Details for Competency SYS-303

SYS-303: Scalable Management of Data and Models

Identity code: SCALABLE_DATA_MODEL_4

Required? No

Credits: 4 (Graded)

Description

No description provided

Responsible Instructor: Akkarit Sangpetch

Prerequisites

- SEN-208 - Advanced Data Structures and Algorithms

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SYS-303:00010	Working with Data Models	Imported assessment	Assessment: Working with different Data Models for given datasets: Given a sets of diverse data, evaluate appropriate data models to be used	Evaluate	<i>None</i>	<i>None</i>
SYS-303:00020	Big data modeling	Imported assessment	Assessment: Understand big data modeling method: Evaluate differences among big data modeling method and its related application	Apply	<i>None</i>	<i>None</i>
SYS-303:00030	Data management systems	Imported assessment	Assessment: Create data management systems for potential services.: Implement a data management mechanism to process large amount of data for a given problem	Create	<i>None</i>	<i>None</i>

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.11.11 Details for Competency SYS-304

SYS-304: Scalable Algorithms and Infrastructure

Identity code: SCALABLE_ALGO_4

Required? No

Credits: 4 (Graded)

Description

No description provided

Responsible Instructor: Akkarit Sangpetch

Prerequisites

- SEN-208 - Advanced Data Structures and Algorithms

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SYS-304:00030	Fundamental Workflow to ML Operation	Imported assessment	Assessment: Design a scalable environment to for developing applications or AI solutions: Given an example scenario of developing an AI solution, comes up with a process of development and potential architectural design to contain a solution	Apply	<i>None</i>	<i>None</i>
SYS-304:00050	Application for ML Model Serving a Web Application	Imported assessment	Assessment: Create and deploy a website that serves the ML model: Develop and deploy a website that will be able to contain the ML model, with a consideration (design) for CI/CD through the process	Analyze	<i>None</i>	<i>None</i>

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.11.12 Details for Competency SYS-401

SYS-401: Parallel Computing

Identity code: PARALLEL.COMP_4

Required? No

Credits: 4 (Graded)

Description

Many potential workloads (e.g., deep learning, rendering, simulation) are large in scale and computations. This requires utilizing the hardware efficiently to maximize performance and reduce power constraints. One way to reduce power constraints is to break large computing units down into multiple small computing units. However, in order to fully utilize those small computing units, the programs should be written systematically with understandings of how each computing units harmonize as well as data movements between/within these units.

This competency introduces how to efficiently utilize parallelism in modern computer systems through programming to improve performance (and implicitly reduce power constraints), including trade-offs involved. This includes parallelism at the instruction and thread levels, as well as, exploiting parallel hardware.

Responsible Instructor: Akkarit Sangpetch

Prerequisites

- SYS-101 - Operating Systems
- SYS-102 - Basic Computer Architecture
- SYS-207 - Networks

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SYS-401:00010	Instruction-level parallelism	Hands-on problem	Write programs that exploit instruction-level and SIMD parallelism: Students will be giving a task to design a code for a certain operation that maximizes ILP and utilizes SIMD instructions.	Evaluate	1, 2, 6	1, 2
SYS-401:00020	Shared memory parallelism	Hands-on problem	Write multithreaded programs and use synchronization properly: Students must parallelize a given implementation using available thread APIs (e.g., pthread, OpenMP) and do proper synchronization to ensure the correctness of the implementation. Students must also compare their sequential implementation with their parallel implementation in terms of performance.	Create	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.11.13 Details for Competency SYS-402

SYS-402: Distributed Data Storage

Identity code: DISTRIB_DATA_4

Required? No

Credits: 4 (Graded)

Description

Storages are one of the most vital components of computer systems. They often dominate the performance of a system, and failures of other components are frequently addressed by restarting from the data stored on them. However, when data is growing, the data storage needs to be scalable and potentially be distributed.

This competency covers the design, implementation, and use of storage and file systems, from the characteristics and operation of individual storage devices to the operating system, and networking approaches involved in tying them together and making them useful in servers and large-scale distributed systems.

Responsible Instructor: Akkarit Sangpetch

Prerequisites

- SYS-101 - Operating Systems
- SYS-205 - Storage and File Systems Fundamentals
- SYS-207 - Networks

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SYS-402:00010	Multiple-disk system	Hands-on problem	Create a multiple-disk system: Students will be given a task to analyze several workloads and design a multiple disk system to satisfy their requirements. Moreover, students will implement a simple software RAID program to demonstrate their understanding on multiple-disk systems.	Analyze	1, 2, 6	1, 2
SYS-402:00020	Distributed file system	Hands-on problem	Create a distributed data storage: Students must be able to implement a basic distributed system with a cache coherence protocol (from either Sprite, NFSv3, or AFSv2) along with an atomicity mechanism (e.g., write-ahead logging, shadow paging).	Understand	1, 2	1, 2
SYS-402:00030	Large-scale data storage	Hands-on problem	Understand design decisions in large-scale data storage systems: Students must be able to summarize key design decisions on existing large-scale data storage systems.	Understand	1	1

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.11.14 Details for Competency SYS-403

SYS-403: Big Data Computing

Identity code: BIG_DATA_4

Required? No

Credits: 4 (Graded)

Description

This competency introduces the essentials of managing and analyzing large-scale datasets. Through practical exercises, learners will work with SQL and NoSQL databases, explore big data processing with tools like Hadoop and Spark, and understand real-time analytics using Spark Streaming. The course also covers IoT data handling, enabling the visualization of data streams and creating cloud-based applications. This competency provides foundational skills to navigate today's data-driven landscape effectively.

Responsible Instructor: Fawad Asadi

Prerequisites

- MAT-206 - Statistical Inference
- SEN-102 - Introduction to Programming

Distribution Areas

- Core Technical

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
SYS-403:00010	Big Data Fundamentals	Imported assessment	Assessment: Understand big data architecture and its application for potential services.: Given various use cases (unstructured and structured), describe how or which data architecture that can be used to serve the use cases	Apply	None	None
SYS-403:00020	Big Data Processing and Analytics	Imported assessment	Assessment: Create distributed Queries & Machine learning method for potential services.: Given a problem, utilize SparkQL or similarly distributed technology to address the problem	Apply	None	None
SYS-403:00030	Data Storage and Management	Imported assessment	Assessment: Create distributed data pipeline method for potential services.: Create a data processing pipeline using distributed architecture	Create	None	None

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.12 URD Pillar

2.12.1 Details for Competency URD-101

URD-101: Undergraduate R&D Project (1)

Identity code: URD_PROJ_1.9

Required? Yes

Credits: 9 (Graded)

Description

URD 101 and URD 102 involve an original, team-based project focused on creating a product or service that could potentially be the basis for a product or an open-source offering.

Responsible Instructor: UNSPECIFIED

Prerequisites

None

Distribution Areas

- Humanities and Social Sciences
- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
URD-101:00010	Entrepreneurship and Innovation	Hands-on problem	Demonstrate skills related to creating new products or services: Working in a team, design and build an innovative system or product. Final results must include deployment strategies and a plan to make the innovation sustainable (e.g. a business plan)	Create	1, 3, 4, 5, 6, 7	1, 2, 3, 4, 5

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.12.2 Details for Competency URD-102

URD-102: Undergraduate R&D Project (2)

Identity code: URD_PROJ_2.9

Required? Yes

Credits: 9 (Graded)

Description

URD 101 and URD 102 involve an original, team-based project focused on creating a product or service that could potentially be the basis for a product or an open-source offering.

Responsible Instructor: UNSPECIFIED

Prerequisites

- URD-101 - Undergraduate R&D Project (1)

Distribution Areas

- Humanities and Social Sciences
- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
URD-102:00010	Entrepreneurship and Innovation	Hands-on problem	Demonstrate skills related to creating new products or services: Working in a team, design and build an innovative system or product. Final results must include deployment strategies and a plan to make the innovation sustainable (e.g. a business plan)	Create	1, 2, 3, 4, 5, 6, 7	1, 2, 3, 4, 5
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.12.3 Details for Competency URD-401

URD-401: Honors Undergraduate Research Thesis (1)

Identity code: HONORS.THESIS_1.12

Required? No

Credits: 12 (Graded)

Description

The undergraduate research thesis competency requires students to engage in independent, original research that addresses some documented problem in the computing or engineering literature. After performing a thorough literature review, students will do theoretical, experimental or prototype development work that is expected to produce some new knowledge or insights about the problem. The primary deliverable is a formal document comparable to a master’s thesis. Publication in a peer-reviewed journal or conference proceedings may be accepted as an alternative deliverable if approved by the student’s research supervisor. Students interested in the honors thesis must register for both URD-401 and URD-402.

Responsible Instructor: UNSPECIFIED

Prerequisites

- URD-202 - Undergraduate R&D Project (4)

Distribution Areas

- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
URD-401:00010	Undergraduate Honors Thesis	Hands-on problem	Contribute original knowledge to the computing or engineering literature: Create theoretical or practical contributions to the solution of some significant computing or engineering problem and document the contributions in a thesis.	Create	1, 3, 7	1, 3
Category		Code	Learning Outcome			
Engineering SLO		1	Engineering problem solving			
		2	Designing to meet requirements			
		3	Effective communication			
		4	Ethical awareness			
		5	Teamwork			
		6	Experimental design and data analysis			
		7	Self-learning			
Computing SLO		1	Computational problem solving			
		2	Designing, implementing and evaluating from requirements			
		3	Effective communication			
		4	Ethical and professional awareness			
		5	Teamwork			

2.12.4 Details for Competency URD-402

URD-402: Honors Undergraduate Research Thesis (2)

Identity code: HONORS.THESIS_2.12

Required? No

Credits: 12 (Graded)

Description

The undergraduate research thesis competency requires students to engage in independent, original research that addresses some documented problem in the computing or engineering literature. After performing a thorough literature review, students will do theoretical, experimental or prototype development work that is expected to produce some new knowledge or insights about the problem. The primary deliverable is a formal document comparable to a master's thesis. Publication in a peer-reviewed journal or conference proceedings may be accepted as an alternative deliverable if approved by the student's research supervisor. Students interested in the honors thesis must register for both URD-401 and URD-402.

Responsible Instructor: UNSPECIFIED

Prerequisites

- URD-401 - Honors Undergraduate Research Thesis (1)

Distribution Areas

- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
URD-402:00010	Undergraduate Honors Thesis	Hands-on problem	Contribute original knowledge to the computing or engineering literature: Create theoretical or practical contributions to the solution of some significant computing or engineering problem and document the contributions in a thesis.	Create	1, 3, 6, 7	1, 3
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.12.5 Details for Competency URD-411

URD-411: Undergraduate Capstone Project (1)

Identity code: CAPSTONE_1-12

Required? No

Credits: 12 (Graded)

Description

The Undergraduate Capstone Project integrates skills and knowledge gained through CIE course work in the context of a practical project. In addition, it develops student capabilities in the areas of effective oral and written technical communication and team-work skills. In the initial stages of the project, students must form teams of 2 to 4 students, then research and develop a project topic, identify a supervisor, and prepare a written proposal. As teams elaborate their design, they should consider application of standards and realistic engineering constraints including economic feasibility, manufacturability, environmental sustainability, and social, political, ethical and safety impacts. The team must produce a proof-of-concept or prototype for their design. At the conclusion of the project, each team must write a comprehensive report about their project, including technical theory and background as well as market analysis if relevant. They must also deliver an oral presentation describing their analysis of the problem, their design and implementation process and their outcomes.

Responsible Instructor: UNSPECIFIED

Prerequisites

- URD-202 - Undergraduate R&D Project (4)

Distribution Areas

- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
URD-411:00010	Computer Engineering Capstone Project	Hands-on problem	Design and develop a project that integrates knowledge from the full undergraduate experience: Work as a team to design a system that solves some practical problem, implement and test the system, and document it in a written report and oral presentation.	Create	1, 2, 3, 5, 6, 7	1, 2, 3, 4, 5
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.12.6 Details for Competency URD-412

URD-412: Undergraduate Capstone Project (2)

Identity code: CAPSTONE_2_12

Required? No

Credits: 12 (Graded)

Description

The Undergraduate Capstone Project integrates skills and knowledge gained through CIE course work in the context of a practical project. In addition, it develops student capabilities in the areas of effective oral and written technical communication and team-work skills. In the initial stages of the project, students must form teams of 2 to 4 students, then research and develop a project topic, identify a supervisor, and prepare a written proposal. As teams elaborate their design, they should consider application of standards and realistic engineering constraints including economic feasibility, manufacturability, environmental sustainability, and social, political, ethical and safety impacts. The team must produce a proof-of-concept or prototype for their design. At the conclusion of the project, each team must write a comprehensive report about their project, including technical theory and background as well as market analysis if relevant. They must also deliver an oral presentation describing their analysis of the problem, their design and implementation process and their outcomes.

Responsible Instructor: UNSPECIFIED

Prerequisites

- URD-411 - Undergraduate Capstone Project (1)

Distribution Areas

- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
URD-412:00010	Computer Engineering Capstone Project	Hands-on problem	Design and develop a project that integrates knowledge from the full undergraduate experience: Work as a team to design a system that solves some practical problem, implement and test the system, and document it in a written report and oral presentation.	Create	1, 2, 3, 4, 5, 6, 7	1, 2, 3, 4, 5
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.12.7 Details for Competency URD-201

URD-201: Undergraduate R&D project (3)

Identity code: URD_PROJ_3.9

Required? Yes

Credits: 9 (Graded)

Description

In URD-201 and URD-202, student teams work with external stakeholders from organizations that are dedicated to solving societal problems. These could be non-profits, non-governmental organizations, or corporate-social-responsibility units within for-profit companies. URD-201 and URD-202 challenge student teams not only to design and build a solution to the stakeholders' problem but to do so considering practical constraints (including financial, technical and knowledge-oriented) faced by the stakeholder organizations.

Responsible Instructor: UNSPECIFIED

Prerequisites

- URD-102 - Undergraduate R&D Project (2)

Distribution Areas

- Humanities and Social Sciences
- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
URD-201:00010	AI and Computer Engineering for Society	Hands-on problem	Demonstrate skills related to solving societal problems while considering the constraints faced by real world stakeholders: Design, build and deploy a sustainable solution to some problem that affects society and impacts the quality of human life.	Create	1, 2, 3, 4, 5, 6, 7	1, 2, 3, 4, 5
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.12.8 Details for Competency URD-202

URD-202: Undergraduate R&D Project (4)

Identity code: URD_PROJ_4.9

Required? Yes

Credits: 9 (Graded)

Description

In URD-201 and URD-202, student teams work with external stakeholders from organizations that are dedicated to solving societal problems. These could be non-profits, non-governmental organizations, or corporate-social-responsibility units within for-profit companies. URD-201 and URD-202 challenge student teams not only to design and build a solution to the stakeholders' problem but to do so considering practical constraints (including financial, technical and knowledge-oriented) faced by the stakeholder organizations.

Responsible Instructor: UNSPECIFIED

Prerequisites

- URD-201 - Undergraduate R&D project (3)

Distribution Areas

- Humanities and Social Sciences
- R&D

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
URD-202:00010	AI and Computer Engineering for Society	Hands-on problem	Demonstrate skills related to solving societal problems while considering the constraints faced by real world stakeholders: Design, build and deploy a sustainable solution to some problem that affects society and impacts the quality of human life.	Create	1, 2, 3, 4, 5, 6, 7	1, 2, 3, 4, 5
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.12.9 Details for Competency URD-301

URD-301: Undergraduate R&D Project (5)

Identity code: URD_PROJ_5.9

Required? No

Credits: 9 (Graded)

Option Group: Third Year R&D Semester 1

Description

Individual or small group projects that apply Artificial Intelligence and computer engineering techniques to novel problems

Responsible Instructor: Panarat Cherntanomwong

Prerequisites

- URD-201 - Undergraduate R&D project (3)

Distribution Areas

- R&D
- XP

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
URD-301:00010	AI Deep Tech Research and Development	Hands-on problem	Apply innovative AI techniques to solve a non-trivial problem: Working with a research supervisor from academia or industry, create engineering solutions using AI that address non-trivial research problems	Create	1, 2, 3, 4, 5, 6, 7	1, 2, 3, 4, 5
Category	Code	Learning Outcome				
Engineering SLO	1	Engineering problem solving				
	2	Designing to meet requirements				
	3	Effective communication				
	4	Ethical awareness				
	5	Teamwork				
	6	Experimental design and data analysis				
	7	Self-learning				
Computing SLO	1	Computational problem solving				
	2	Designing, implementing and evaluating from requirements				
	3	Effective communication				
	4	Ethical and professional awareness				
	5	Teamwork				

2.12.10 Details for Competency URD-302

URD-302: Undergraduate R&D Project (6)

Identity code: URD_PROJ_6.9

Required? No

Credits: 9 (Graded)

Option Group: Third Year R&D Semester 2

Description

Individual or small group projects that apply Artificial Intelligence and computer engineering techniques to novel problems

Responsible Instructor: Panarat Cherntanomwong

Prerequisites

- URD-301 - Undergraduate R&D Project (5)

Distribution Areas

- R&D
- XP

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
URD-302:00010	AI Deep Tech Research and Development	Hands-on problem	Apply innovative AI techniques to solve a non-trivial problem: Working with a research supervisor from academia or industry, create engineering solutions using AI that address non-trivial research problems	Create	1, 2, 3, 4, 5, 6, 7	1, 2, 3, 4, 5
Category		Code	Learning Outcome			
Engineering SLO		1	Engineering problem solving			
		2	Designing to meet requirements			
		3	Effective communication			
		4	Ethical awareness			
		5	Teamwork			
		6	Experimental design and data analysis			
		7	Self-learning			
Computing SLO		1	Computational problem solving			
		2	Designing, implementing and evaluating from requirements			
		3	Effective communication			
		4	Ethical and professional awareness			
		5	Teamwork			

2.12.11 Details for Competency URD-311

URD-311: Overseas Colleges (1)

Identity code: OVERSEAS_1.9

Required? No

Credits: 9 (Graded)

Option Group: Third Year R&D Semester 1

Description

No description provided

Responsible Instructor: Panarat Cherntanomwong

Prerequisites

- URD-201 - Undergraduate R&D project (3)

Distribution Areas

- XP

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
URD-311:00010	Overseas Study	Imported assessment	Participate in educational activities at a non-Thai institution: Exchange study at an overseas university.	Evaluate	3, 4, 7	3, 4

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.12.12 Details for Competency URD-312

URD-312: Overseas Colleges (2)

Identity code: OVERSEAS.2.9

Required? No

Credits: 9 (Graded)

Option Group: Third Year R&D Semester 2

Description

No description provided

Responsible Instructor: Panarat Cherntanomwong

Prerequisites

- URD-202 - Undergraduate R&D Project (4)

Distribution Areas

- XP

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
URD-312:00010	Industrial Internship	Imported assessment	Contribute to the work of an industrial partner: Perform assigned duties and contribute to the working team on the site of the industrial sponsor	Evaluate	3, 4, 5, 7	3, 4, 5

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.12.13 Details for Competency URD-321

URD-321: Industrial Internship (1)

Identity code: INTERNSHIP_1_9

Required? No

Credits: 9 (Graded)

Option Group: Third Year R&D Semester 1

Description

This competency is intended to give students practical experience working on-site in a company or research institution as part of an existing team. Students will fill a specific role determined by their supervisor at the host institution and will participate in the day-to-day activities of the institution, working on assigned tasks and contribution to their team of colleagues. Internships usually last for three months (one semester) but may be extended.

Responsible Instructor: Panarat Cherntanomwong

Prerequisites

None

Distribution Areas

- XP

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
URD-321:00010	Industrial Internship	Imported assessment	Contribute to the work of an industrial partner: Perform assigned duties and contribute to the working team on the site of the industrial sponsor	Evaluate	3, 4, 5, 7	3, 4, 5

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork

2.12.14 Details for Competency URD-322

URD-322: Industrial Internship (2)

Identity code: INTERNSHIP_2.9

Required? No

Credits: 9 (Graded)

Option Group: Third Year R&D Semester 2

Description

This competency is intended to give students practical experience working on-site in a company or research institution as part of an existing team. Students will fill a specific role determined by their supervisor at the host institution and will participate in the day-to-day activities of the institution, working on assigned tasks and contribution to their team of colleagues. Internships usually last for three months (one semester) but may be extended.

Responsible Instructor: Panarat Cherntanomwong

Prerequisites

None

Distribution Areas

- XP

Skill Code	Topic	Assessment Type	Assessment	Complexity Level	Engineering SLO	Computing SLO
URD-322:00010	Industrial Internship	Imported assessment	Contribute to the work of an industrial partner: Perform assigned duties and contribute to the working team on the site of the industrial sponsor	Evaluate	3, 4, 5, 7	3, 4, 5
URD-322:00020	Industrial Internship	Imported assessment	Summarize the work done during the industrial internship in a report: Summarize the work done during the industrial internship in a report	Evaluate	3, 4, 5, 7	3, 4, 5

Category	Code	Learning Outcome
Engineering SLO	1	Engineering problem solving
	2	Designing to meet requirements
	3	Effective communication
	4	Ethical awareness
	5	Teamwork
	6	Experimental design and data analysis
	7	Self-learning
Computing SLO	1	Computational problem solving
	2	Designing, implementing and evaluating from requirements
	3	Effective communication
	4	Ethical and professional awareness
	5	Teamwork